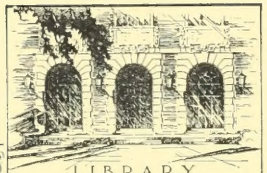
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ALASKAN MOOSE.
(Alces gigas).

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In Natural Colors by Color Photography

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VOL. V—ANIMALS

AMERICAN AUDUBON ASSOCIATION
CHICAGO

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CONTENTS

CHAPTER		PAGE
I	The Shell Tribe	9
II	The Insect Tribe	35
III	The Fish Tribe	63
IV	The Reptile Tribe	83
V	A Noted Hooved Group	91
VI	A Group of Rodents	113
VII	Noted Carnivorous Animals	135
VIII	The Cat Tribe	149
IX	The Dog Tribe	159
X	Some Strange Mammals	169
XI	The Monkey Tribe	183

Animals

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CHAPTER I

THE SHELL TRIBE

In this chapter are illustrations of various forms of animal structure for support or protection. In most of the cases here given the "shell" is external to the body, but in corals and starfishes it is imbedded in the skin. Certain glands of the animal's skin secrete and deposit carbonate and phosphate of calcium, or mineral matter, in a way quite similar to our own secretion of perspiration or of tears. Sometimes, as in the starfishes, the lime is deposited as separate particles; among the snail-like mollusks this mineral matter takes the form of a single solid shell, while the clam-like forms have a shell of two separate portions. Whenever the outer tissues of the body are projected as frills or flutings, then will the shell take on a similar form; the color of a shell is caused by pigments being deposited along with the mineral matter. The outer tissue, or mantle, of nearly all mollusks has the power to secrete and deposit lime, together with fibers of animal matter and more or less coloring matter. Wherever this mantle is of unusual form the shell will be similar; thus arise the peculiar spines and roughenings of many shells.

H. B. Shinn.

CORALS

The animals commonly known as Corals (sea Anemones and Polyps) have been very appropriately called zoöphytes, or flower animals, from their close external resemblance to flowers and also from their variety of brilliant coloration. Many species, as the sea fans, sea plumes, and sea whips, grow in a manner so like the shrubs and trees that until a comparatively recent date they deceived even the men of science. The older naturalists classified many of them as plants, and it was not until the middle of the eighteenth century that their true character became definitely known.

These animals form a part of the sub-kingdom *Coelenterata* and in classification are placed between the sponges *(Porifera)* and the planarian worms. The name *Coelenterata* is well chosen. It signifies a hidden digestive tract and refers to the fact that the stomach is concealed in the lower part of the body, directly in the center of the animal.

The general plan of all coral animals is essentially as follows: The body is rounded, cylindrical, and sac-like, and is divided internally by partitions called mesenteries, which are usually six or eight in number. In the center of the body and suspended by the partitions is placed the stomach, which is connected with the body cavity by little openings. The mouth is placed in the center of the upper surface and is surrounded by a circle of tentacles. The most notable character of these animals is the presence of stinging organs known as lasso-cells, which have the power of throwing out

REEF BUILDING CORALS.

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Porites astraeoides (Florida).

Agaricia agaricites (Bahamas).

Madrepora prolifera (Florida).

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HYDROYD CORALS.

Distichopora nitida (East Indies).

Millepora alcicornis (Florida).

Stylaster sanguineus (East Indies

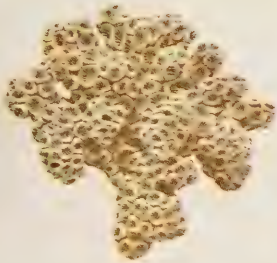
little barbed bodies or nettling cells which serve as a means of defense and also as a means of procuring food.

The animals comprised in this branch of zoölogy differ widely in external form. They range from the minute hydroids which encrust stones at low water to the beautiful stone-building corals, the brilliant sea anemones, and the curious jelly-fishes. Some are stationary for life, while others swim about from place to place. Some live on the surface of the ocean, while others live at the bottom of the sea, in very deep water. With the exception of a few small hydroids, all are marine, and the majority of these live near the shores of continents and islands. Typically they are tropical animals, although a number, particularly the jelly-fishes, live in northern seas, and some of the Gorgonias live in the Arctic seas at a considerable depth. These animals are directly of little use to man, but indirectly they have done more for him than almost any other animal. The stony corals have built up islands, added to the growth of continents, and their fossilized remains are now used for building purposes under the names of marble and limestone. They have been engaged in this work for millions of years and we find their remains in the oldest geological rocks. In many places, as at Cincinnati, Chicago, and parts of Ohio and Indiana, extensive ancient reefs have been found which show that this class of animals flourished in large numbers in the old Silurian sea.

The sub-kingdom *Coelenterata* is divided into four classes: the *Hydrozoa,* which includes such animals as the fresh-water hydra and the little incrusting hydroids of the sea shore; the *Scyphozoa,* or the jelly-fishes; the *Anthozoa,*

including the stony corals, the sea anemones, sea fans, and sea plumes, and the *Ctenophora,* or comb-bearers, which are small, rounded, jelly-like animals of peculiar form.

The class *Anthozoa* is divided into two sub-classes, of which the first, the *Alcyonaria,* will be considered in this article. In this group each animal or polyp has eight pinnate tentacles and the same number of mesenteries, or partitions. All are marine and the great majority form colonies which assume arborescent, or tree-like, forms. The growth of these masses is very interesting, but difficult to understand from the dried specimens usually seen in our museums. When alive each branch or coral stock is composed of soft, fleshy tissue, called the *coenenchyma,* throughout which there ramify hundreds of little, irregular canals which serve to connect the polyps with each other. Scattered over the surface of this fleshy foundation are many little cylindrical coral animals (polyps) the distal end of which is surmounted by eight pinnate tentacles which surround the oval mouth. The outer skin, called *sarcosome,* forms a calyx or cup into which each polyp may be withdrawn and completely concealed when disturbed. The *coenenchyma,* as well as the polyp itself, is more or less supported by numerous calcareous spicules, which may be scattered throughout the mass or may form a regular skeletal support, as in the hard part of the precious coral and the fan-like structure of the sea-fans. In one family there is a horny secretion which covers the polyp. The alcyonarian polyps increase in size by a system of budding from the sides or top of the coral stock. The fleshy stock, or foundation, pushes forward its ramifying canals, which carry nutritive material,



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STONY CORALS.

Manicina areolata (Florida).
Fungia dentata (Singapore).
Galaxea fascicularis (Samoa).

Pocillopora meandrina (Sandwich Islands).
Oculina paliens (Florida).
Euphyllia wardii (Ship Spoke).

and at the base of an old polyp or on disk-like expansions new polyps begin to grow or bud out, much as do the buds of a flower. By a constant budding in this manner a large coral stock may be built up. These animals have no special outlet for the waste products of digestion. These are thrown out of the mouth when all nutritive matter has been extracted.

The lowest forms belong to the order *Alcyonacea,* which includes many corals supported by a fleshy coral stock. In many cases these animals encrust foreign objects. The most familiar member of this order is the organ coral *(Tubipora musica).* This coral is common throughout the Indian and Pacific oceans and the coral stock often attains an immense size. Each coral polyp forms a red tube and each series of polyps is separated from the series below by a horizontal partition, so that in a large specimen of this coral stock there seems to be a number of tiers of tubes, each tube being separated from the one above and below by a flat partition or floor. It is this peculiar form which has given it the name of organ coral. Each little polyp is able to retract into its tube and thus secure protection from its enemies.

In the order *Pennatulacea,* or sea-pens and sea-feathers, the coral polyps form upon a stock called the rachis. This bears a stalk which is embedded in the mud or sand. The colonies are more or less locomotive and are able to move from place to place. One of the most striking forms of this order is the Renilla, the rachis of which is spread out in the form of a leaf or a kidney. A long pedicel or stem extends from the lower surface and anchors the colony to

some foreign object by means of a peculiar polyp-like organ called a siphonozoid, or siphon-animal. The upper surface of the rachis is covered with many little coral polyps, which are attached to the rachis by a rather long stem. The tentacles are wide and covered with little feather-like expansions on the edges. The rachis is of a rich purple color, the polyps being of a much lighter shade. According to Agassiz, these animals are remarkably phosphorescent, emitting "a golden green light of a most wonderful softness." They are found in the Gulf of Mexico and in the Atlantic and Pacific oceans. Many of the sea-pens form a long, feather-like rachis, not a few of which live in very deep water.

Another order is the *Gorgoniacea,* which includes the large and showy sea-fans and sea-plumes. They are all attached to some solid base and the axis, or coral stock, is more or less firm and is covered by a fleshy coenechyma. The coral polyps project from this fleshy covering and when their tentacles are expanded they resemble many little stars. The best-known members of this order are found in the family *Gorgoniidæ.* The common *Gorgonia flabellum* or sea-fan, is a most beautiful object, the vertical and lateral extensions of the coral stock forming an exquisite lattice work. In the sea-plume, *Gorgonia acerosa,* the coral stock does not form a lattice work, but a few long and straight branches support a countless number of small fronds which extend from each of the main stems at regular intervals. To fully appreciate and understand these animal colonies one must imagine this fan or plume to be covered with polyps, each with its little expanded tentacles. Add to this the colors, yellow, white, brown, red, crimson, purple, orange,

CORALS.

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Orange Sea Fan (Eugorgia aurant . . . California.

Organ Coral (Tubipora musica) East Indies

. . . Gorgonia acerosa. Bahamas

or black, and the picture of these exquisite creatures is complete. A species from California, the *Eugorgia aurantiaca,* is bright orange-red in color and its branches are rather stiff. In the family *Plexauridæ* the branches are very thick and heavy, resembling in some respects a sponge, and the polyps are placed very close together. The genus *Eunicea* is the most common and best-known member of this family. The most valuable Alcyonoid coral is the red or precious coral *(Corallium rubrum).* It is the only member of this sub-class which has a coral stock or axis hard enough to polish. This property has led it to be much used for jewelry and for a number of years it has been collected for this purpose. The polished article is quite unlike the coral as it is taken from the water. Instead of being smooth and polished it is roughened by many little ribs running longitudinally, giving the coral a fluted aspect. The family *Antipathidæ,* although not classed as *Alcyonaria* by many zoölogists, contains some interesting forms. The coral stocks are called sea-whips and are very long, flexible, and of a black color. The overseers of the Spanish plantations formerly used these sea-whips to punish their slaves, and when twisted or braided together and knotted they must have been veritable instruments of torture.

FRANK COLLINS BAKER.

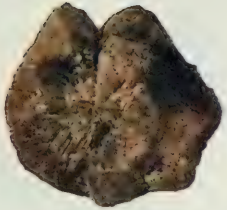
PEARLS

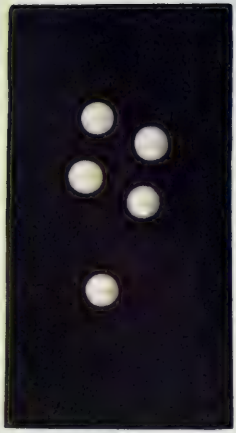
Pearls of perfect form are generally found in the pearl oyster of warm oceans; fresh-water pearls are often imperfect and are called "slugs"; their value is not great. In

any case, some foreign object has lodged between the shell and the delicate tissue of the oyster or clam; this causes irritation, just as a cinder does in the human eye, and the animal covers the object with delicate layers of lime, gradually increasing the size of the pearl. The center of these pearls is very often a small parisitic worm, or it may be a grain of sand, or even one of the animal's own eggs. In the Indian Ocean pearl oysters are obtained by native divers. The day's catch is tied in sacks, piled on the beach, and, without close inspection, bought by brokers. After the oysters have been allowed to decay the sacks are opened and the contents washed in troughs of water. Natives, sitting naked beside the troughs and under close guard, squeeze the mass through their fingers. The animal matter is thus washed off and the remaining pearls removed and sorted. Those of best quality and largest size are used in jewelry, while the very small ones are used by Chinese physicians, who burn, or calcine, them and prescribe them as a mild alkaline remedy.

Jade is a very hard and tough mineral, of somewhat glassy composition and texture, which was formed in the heated interior of the earth. Since prehistoric times it has been much used by man for ornamentation because of its beautiful color and its durability.

Chrysaberyl is a very rare gem, which, when polished, is the "oriental cat's eye." H. B. SHINN.





Left. Valve of Jacobi, Curved Rarrida.
Lower Secondary, Polished (Modern) Greek Sea

Chrysostoma Bicolor
Fresh Water Pearl Mussel's Shell
Jade, Variety Nephrite, Polished — New Zealand

Right. Oculina
Precious Coral (Mediterranean Sea)

STARFISHES.

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Asterias ochracea (California).
Asterias forbesii (Rhode Island).
Nidorella armata (Panama)

Asterias vulgaris (Massachusetts).
Asterias forbesii (Massachusetts).
Asterina miniata (California).

STARFISHES

One of the most unique and interesting branches of the animal kingdom is that division called by scientists *Echinodermata,* comprising animals familiarly known as Starfishes, Sea Urchins, Sand Dollars, and Sea Cucumbers. So far as is known no member of this group of animals has ever ventured on land or into fresh water. All are inhabitants of the ocean and are found from the tide-washed shore to the abysses of the sea.

The present article deals with the true starfishes *(Asteroidea),* and a good idea of the general structure may be gained by a careful examination of a specimen of the common five-finger *(Asterias vulgaris)* so common along the New England coast. It is made up of a central disk, or body, from which extend five rays or arms, whence the name starfish. The animal is protected by a hard framework or skeleton, composed of many limestone plates attached by a tough membrane and covered with a skin. Between these plates there are many small openings through which the water enters the body cavity.

The true vascular, or blood, system consists of a heart, or hæmal canal, which runs parallel with the stone canal from the madreporic body to the oral water tube. A set of circular and radial vessels supplies every part of the animal with the vital fluid.

The digestive system is simple and consists of a mouth, a stomach, which is large and sends a lobe into the base of each arm, and an intestine of greater or lesser length ending

in a small anal opening on the dorsal surface. The cœca, or liver, consists of two long tree-like masses, nearly filling each ray and connecting with the stomach by a short duct.

Starfishes are very destructive to the oyster beds along the Atlantic Coast of the United States, thousands of bushels of oysters being destroyed in a few days by them. The little starfishes attack the young oysters, and as the former increase in size they move about in vast numbers, resembling in this respect the grasshoppers and locusts of the West and being fully as destructive.

Frank Collins Baker.

SEA URCHINS AND SAND DOLLARS

Sea Urchins and Sand Dollars would scarcely seem, at first sight, to be related to the starfishes, yet they are in many respects identical in structure. In the sea urchin the five rays of the starfish are rolled together to form a spherical or flattened disk, which is covered with spines of greater or lesser length. These spines work in a ball-and-socket joint and are are capable of considerable movement. The intestine in the sea urchins is usually long and is twisted about in the shell in a manner similar to that of the human intestine. This great length is necessary to accommodate the large quantities of sand which the sea urchin swallows to obtain the minute animals which it contains.

In one respect the sea urchins are unique, viz.: in the possession of a peculiar dental apparatus known as "Aristotle's Lantern." This is composed of five teeth which are operated by a complicated system of muscles. When exam-

SEA URCHINS.

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Melita testudinata (Florida).
Arbacia dufresnii (Argentina).
Diadema setosum (West Indies).
Echinarachinus excentricus (California).
Strongylocentrotus drobachiensis (Massachusetts).
Hipponoe esculenta (Bahamas).

SHELLS

ined closely this apparatus is seen to be made up of five triangular pieces which terminate in a sharp tooth, each one being reinforced on the inside by a heavy rib. With these teeth the sea urchin is able to dig up quantities of sand containing minute foraminifera and to browse along the rocks which are covered with marine vegetation.

Unlike the starfish, the sea urchin is a lover of home, for we find him scooping out great holes in the rocks along the shore, in which he lives most of the time, leaving them only when in search of food.

The sea eggs and sea porcupines are, as a general rule, inhabitants of rocky shores, while the flat urchins, like the sand dollars and key-hole urchins, live on sandy beaches in more or less sheltered bays, where they bury themselves in the sand, either wholly or in part.

The sea urchins present an endless variety of forms; some have large shells with short, bristle-like spines, while others have small shells with long spines.

FRANK COLLINS BAKER.

SHELLS AND SHELL-FISH*

Scientific Name	*Common Name*	*Where Found*
1. Turbo Argyrostona	Silver Mouth	Singapore
2. Strombus Bitubereulata	Kid Conch	West Indian Islands
3. Nerita Peleronta	Bleeding Tooth	West Indies
4. Strombus Urceus		Amboina
5. Turbo Sarmaticus	Turk's Cap	Algoa Bay
6. Cypræa Argus	Eyed Cowry	New Caledonia
7. Helix Hæmastoina	Red-mouth Snail	Ceylon
8. Murex Pomum		Florida

	Scientific Name	*Common Name*	*Where Found*
9.	Oliva Inflata		Singapore
10.	Conus Aranatus	Sandy Cone	Red Sea
11.	Fascioloria Tulipa		West Indies
12.	Conus Leoninus		Florida
13.	Spondylus Pictorum		California
14.	Conus Literatus	Lettered Cone	Ceylon
15.	Haliotis Iris	Green Abalone	Japan
16.	Terebra maculata	Marlin Spike	Sandwich Islands
17.	Murex Regius	Red Murex	Panama
18.	Oliva Porphyria	Tent Shell	Panama
19.	Murex Bicolor	Pink Murex	Mexico

Shells consist of carbonate of lime secreted by the animal and intermixed with some animal matter. In the species in which it is least developed it appears as a hollow plate, which serves as a protection to the breathing organ and heart.

The distinguishing marks of shells are the number of parts of which they are composed, and their peculliar forms and prominences. Some consist of a single piece, some of two pieces, and some of three. The textures of shells are described as pearl, fibrous, horny, and some are grassy and translucent. The pearly shells are in alternate layers of very thin albuminous membrane and carbonate of lime, which by their minute undulations give the pearly luster to the shell.

The whole number of species of molluscous animals known is estimated at about twelve thousand recent and fifteen thousand fossil. Many of the living species furnish wholesome food, and some are esteemed as delicacies. The marine shells, by the immense numbers in which they

COWRY SHELLS.

Cypraea exanthema (half grown).
Trivia solandri (California).
Cypraea erosa (Indian Ocean).
Cypraea spadicea (California).
Cypraea talpa (Pacific Ocean).

Cypraea exanthema (young).

Cypraea mus (Europe).

Cypraea exanthema (Florida)
Cypraea annulus (Indian Ocean)
Cypraea lurida (Mediterranean Sea)
Cypraea moneta (Philippines).
Cypraea histrio (Indian Ocean)

are produced, perform an important office in abstracting from the sea water its excess of calcareous matter and thus aid in maintaining its purity.

THE COWRIES AND SHELL MONEY

Among marine mollusks none stand so favorably in the eyes of collectors or are so beautiful as the *Cypræas,* or Cowry shells. With their glossy coats and varied colors they are indeed gems of the ocean, and it is little wonder that the conchologist has placed them first among the many families of marine shells.

The name *Cypræa* comes from Cypris, one of the names of the goddess Venus. About two hundred recent species have been described, and they are found in nearly all parts of the world, though more numerous in the tropics and subtropics, where they live on coral reefs and under rocks. As in many other genera of shells, the cowries living in the tropics are more brilliantly colored than those from more temperate climes, a condition due to the large amount of sunshine and high temperature, both of these factors being essential to the secretion of color in the pigment cells of the animal.

The animal which inhabits a cowry shell is a curiosity. The foot is large and spreads out in a wide mass, enabling the animal to glide along quite rapidly. The mantle lobes are folded over the back of the shell and are beset with many little tuft-like organs which stick out like young shoots on a plant. The mouth is placed at the end of a rather long snout or rostrum and the eyes are upon the outside of two

long, tapering tentacles, about one-third the distance from the body.

The Money Cowry is also used as ornaments on the trappings of horses and elephants, as well as on the persons of men and women. The rich yellow variety is much sought after by the chiefs of several island tribes, who permit no one but themselves or their sub-chiefs to wear them.

We may truly say that of all the mollusks, large or small, handsome or ugly, the modest little money cowry surpasses any in point of economical importance.

FRANK COLLINS BAKER.

MARINE SHELLS

Among the best known of the marine snails are the Tritons, a family of mollusks living in tropical seas. Their shells are generally large and highly colored and variously ornamented with short spines and knobs. Another shell familiar to those who have visited Florida is the Fasciolaria or banded snail, which attains a length of three inches and is very prettily banded and dashed with color. A near relative of this species is the giant banded shell *(Fasciolaria gigantea)*, which is the largest of all marine snails, growing to a length of nearly two feet.

A genus of mollusks with light horn colored shells, and inhabiting the cold waters of the Arctic seas, is the Buccinum, or Whelk. The whelk is used economically, both for food and bait. A related genus, the Neptune shells *(Neptunea)*, is also eaten by the poorer people, and makes a good codfish bait.

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406

MARINE SHELLS.

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Cypraea pantherina (Red Sea)
Buccinum undatum (U. S.)
Cassis flammea (Bahamas)
Conus marmoreus (Polynesia)
Fasciolaria distans (U. S.)
Tritonium olearium (Naples)
Oliva irisans (Amboina)
Voluta musica (West Indies)
Ianthina communis (Atlantic Ocean)
Chiton squamosus (Jamaica)
Lottia gigantea (California)
Nassa glans (Amboina)

The Nassas of France are very destructive to the oyster beds of that nation, an adult "borer" being able to perforate the shell of a large oyster in a single night.

Of the many varieties of tropical shells, few exceed the Volutes, or bat shells, in beauty or variety of coloration.

On the sandy shores of sub-tropical beaches certain graceful and polished animals bury themselves from sight in the sand. These are the olive shells *(Oliva),* whose bright colors and highly polished surfaces rival even the gaudy volute in beauty.

Probably no more distinct family of mollusks exists than the *Conidæ,* the family of cones, their beautifully decorated shells and the large number of species making them a favorite with collectors.

The *ne plus ultra* of mollusks to the collector is without doubt the genus *Cypræa,* comprising the cowry shells.

Cameos were at one time quite in the fashion, both as ornaments for the person in the way of brooches, and as bric-a-brac about the room. These shell-cameos are made from the genus *Cassis,* the helmet shells.

One of the most abundant of mollusks is the violet sea snail *(Ianthina communis),* which spends its life floating in the waters of the Atlantic Ocean. The shell is very delicate, resembling in form some of the land snails, and has but two colors, both shades of violet, a deep color on the under side.

FRANK COLLINS BAKER.

THE ROCK SHELLS

There are shown on the plate eight species of Rock Shells, all more or less common. The first one for us to consider may be called Venus' Comb *(Murex tribulus)*, and is found in China, Japan, and the Indian Ocean. It belongs to a group of shells which is characterized by a long snout or canal, and long, pointed spines. The color is yellowish; in one variety the spines are tipped with black.

A shell which is found on the mantel in every household is known as the Branched Rock Shell *(Murex ramosus)*, which is widely distributed, being found in the Red Sea, the Indian Ocean, New Zealand, Australia, and the central Pacific Ocean, and attains a large size, some specimens reaching the length of a foot and weighing several pounds. The aperture is frequently tinged with a deep, beautiful pink. In many households the large shells of this species are used for flower pots, suspended from a hook over the window by a set of chains, and for this purpose they are certainly very ornamental.

The Apple Murex *(Murex pomum)* is of home production, being found on the shores of Florida and throughout the West Indies. It is not as attractive as the shells just mentioned, but is very common, every collector possessing several specimens in his cabinet.

In the aperture of this species will be noticed a dark brown object, which is known as an operculum or door, and its use is to close the aperture when the animal withdraws into its shell, so that the latter may be safe from its enemies.

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SHELLS
Reduced $\frac{1}{10}$

Root Murex.
Burnt Murex.
Purple Murex.

Venus Comb.

Apple Murex

Branched Murex.
Horned Murex.
Two-colored Murex.

All of the rock shells possess this organ, which is attached to the back part of the animal's foot.

A peculiar and somewhat rare shell is the Horned Murex *(Murex axicornis)*, found in the Indian Archipelago, whose shell is made up of many curiously fluted spines. The Burnt Murex *(Murex adustus)* is an inhabitant of the Indian Ocean, Japan, and the Philippines, and its name, which signifies burned, is well chosen, for all its spines and frills and most of the shell are black in color and look just as though the shell had been scorched. The aperture is often beautifully tinged with pink or dark red.

A common rock shell found in the Mediterranean Sea, as well as on the Atlantic coast of France and Portugal and the Canary Islands, is the Purple Murex *(Murex trunculus)*. This is a light brown, three-banded shell about two inches in length and is famous as having been used by the ancients to obtain their beautiful and rich purple dye. On the Tyrian shore these shells were pounded in caldron-shaped holes in the rocks, and the animals were taken out and squeezed for the dye which they secrete. If the animal of one of our common purpuras, a small shell found along the Atlantic and Pacific coasts, be squeezed, it will exude a purple fluid which will stain fabrics a reddish-purple. It is probable that much or most of the royal purple of the ancients was obtained from these lowly creatures.

Although the most beautiful shells of this family are supposed to live in the warm tropical seas of the Indian Ocean, it is nevertheless true that many of the most brightly colored rock shells live in the warm waters of Panama and Mazatlan. The Root Murex *(Murex radix)* is one of these

shells, which attains a length of five inches and weighs several pounds. The shell is white or yellowish-white and the spines and frills are jet black, the two colors producing a peculiar effect. Another beautiful shell from the same locality (Panama) is the Two-colored Murex *(Murex bicolor)*, a shell attaining somewhat larger dimensions than the last. The spines are reduced to mere knobs in this species, there are but a few frills, and only two colors, the shell being greenish-white and the aperture a deep red or pink, plainly showing whence the name, bicolor, two-colored. This shell is collected by thousands at Panama and shipped all over the United States to curiosity stores at summer watering places and other vacation resorts, where they are sold at from a few cents to a dollar each, according to quality. FRANK COLLINS BAKER.

THE OYSTER AND ITS RELATIVES

One of the most attractive families of bivalve shells is the *Veneridæ*, or Venus Shells, in which the shelly skeleton is ornamented by many bright colors, the patterns occurring in spots, dashes, zigzag lines, and rays. Some varieties, as the spiny venus *(Cytheria lupinaria)*, have the posterior end of the shell provided with long, sharp, curved spines, and the shell is also frilled in a beautiful manner. The common quahaug (round or hard-shelled clam), which is esteemed an article of diet on the Atlantic coast, and also to some extent in the interior, is a prominent member of this family. The *Veneridæ* comprise some five hundred species, found throughout the world, and ranging from the

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THE OYSTER AND ITS RELATIVES.

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Cytherea lupinaria (Panama).
Ostrea lucerana (Bahamas).
Pecten dislocatus (Florida).
Pteria radiata (Florida).

Spondylus imperialis (China).

Anapsilis luteola (U. S.)
Mytilus edulis (U. S.).
Cardium isocardia (Florida).
Tellina radiata (Florida).

shore between tides to several hundred fathoms in depth. The family *Cardiidæ*, the Heart-shells or Cockles, comprise some of the largest and most attractive of mollusks. The name *Cardium*, signifying a heart, is given them because of the close resemblance to that organ when a shell is viewed from the anterior end.

In the family *Tridacuidæ* size seems to have reached its limit. *Tridacna gigas*, found in the Indian Ocean, grows to a length of nearly six feet, and weighs upwards of eight hundred pounds.

The *Tellinas* (family *Tellinidæ*) numbers among its five hundred or more species some very beautiful and interesting animals. They live for the most part buried in sand or sandy mud and are found throughout the entire world.

Closely related to the *Tellinidæ* are the *Psammobiidæ*.

One of the most familiar objects to the seaside visitor is the huge banks of sea-mussels which line the shore at low water. The shells are generally dark-colored, our common mussel *(Mytilus edulis)* being frequently jet black, and are more or less wedge-shaped in form.

The family *Aviculidæ*, comprising the wing-shells or pearl oysters, is of great interest, both scientifically and economically.

The scallop is an object well known to the tourist visiting New England summer resorts, who has reveled in "fried scallops." The family to which this belongs *(Pectinidæ)* is composed of rounded shells, many with frills or ribs, and nearly all ornamented with beautiful colors.

The most common shell to the layman is the oyster

(Ostrea virginica), the cultivation of which occupies the attention of a large number of men and the investment of considerable capital. The oyster is free and active when young, but becomes attached to some submerged object early in life. FRANK COLLINS BAKER.

SNAILS OF POND, RIVER, AND BROOK

Our fresh-water snails may be divided into two classes: first, those which breathe by means of a lung and which must come to the surface at regular intervals to take in a supply of air; and, second, those which breathe by means of plume-like gills, which take the oxygen directly from the water.

One of the most common and best known of the first class is the *Limnæidæ,* comprising the Pond Snails. These animals have generally a long, graceful shell, horn-colored for the most part, but sometimes greenish without and reddish within the aperture. The animal has a broad, flat foot, an auriculate or eared head, and flat, triangular tentacles.

The habits of these animals are very interesting. They will wander about the sides of an aquarium, eating the growths of green scum which have collected. At this time the mouth may be seen to open, exposing the radula, and the operation of eating is not unlike the motions of a cat lapping milk. They are such voracious eaters that the dirtiest aquarium will be cleansed by them in a very short time. It is interesting to note that the young animals breathe air through the water for a long time, and finally acquire the

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POND SNAILS AND RIVER SNAILS.

Physa gyrina (U. S.)

Pleurocera elevatum (U. S.)
Vivipara contectoides (U. S.)

Melania tetrica (Viti Islands.)
Planorbis trivolvis (U. S.)
Ampullaria depressa (U. S.)
Campeloma subsulidum (U. S.)

Angitrema verrucosa (U. S.)

Limnaea stagnalis (U. S.
Limnaea megasoma (U. S.

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LAND SHELLS.

Epiphragmophora fidelis (California).
Cyclophorus appendiculatus (Philippines).
Polygyra albolabris (")
Polygyra profunda (")
Omphalina fuliginosa (")
Cerion microstoma (Cuba).

Helix pomatia (Europe
Acavus haemastomus (India).
Nanina lamarckiana (Philippines).
Achatinella (Sandwich Islands
Clausilia macaroni (Dalmatia
Drymaeus multilineatus (Florida).

Ligunus fasciatus (Florida).
Strophocheilus chilicnsis (South America).
Glandina truncata (Florida
Cochlostyla intorta (Philippines).
Helix nemoralis (Europe).

normal characteristic of the family of breathing the air directly. While submerged, the mantle chamber containing the "lung" is tightly closed, so that no water can possibly get in.

The second class of mollusks, or those that breathe air through the water, have a respiratory cavity instead of a lung, in which is placed a series of leaflets, arranged like the teeth of a comb in two series of lines, forming the so-called gills. The mouth also is placed at the end of a long rostrum, or proboscis, and not in the lower plane of the head, as in the first class. Among the most common of this class are the River Snails, known as *Strepomatids*. There are about three hundred species in this family, and with two or three exceptions they are confined entirely to the United States in geographical distribution. The shells are more or less graceful, having long, turreted spires and small apertures.

FRANK COLLINS BAKER.

SNAILS OF THE FOREST AND FIELD

Land Snails are found almost everywhere — in valleys, high up on mountains, and even in deserts. They may be found in the cold climate of Alaska or in the tropical zone under the equator.

The shells of the *Pulmonata* vary to a wonderful degree in size, shape, and coloration. Some are so small that they can scarcely be seen with the unaided eye, while others attain a length of six inches.

Much is written at the present time upon our new possessions, the Philippine Islands, but few people are aware

that these islands are tenanted by the most interesting and beautiful group of all the land shells, the *Cochlostylas,* or tree snails. The animals live for the most part in the trees and bushes of the islands, the island of Luzon having, probably, the best known fauna.

The land shells of the United States, while numerous in species, are not as conspicuous in color pattern as those of Europe, South America, or the islands of the Indian and Pacific oceans, although California produces some highly colored species, as will be seen by consulting the figure of *Helix fidelis,* on our plate. The majority of our species are uncolored, like the figure of *Polygyra albolabris.*

One of the largest and most interesting of American shells is the *Bulimus,* found in South America. The shell of *Bulimus ovatus* attains a length of six inches and the animal is correspondingly large.

One of the most beautiful of the land shells found in the United States is the *Liguus fasciatus,* found in Florida and Cuba. The shell is about two inches long and is encircled by bands of white, brown, and green. This species lives in great numbers at Key West, associated with many small shells of the *Bulimus* group. Closely related to the last-mentioned shell *(Liguus)* is the agate shell *(Achatina),* which attains a length of seven inches, and is the largest of the land shells.

Among the edible snails none excels in public favor the common edible snail of Europe *(Helix pomatia).* The cultivation of this animal has become an established business, like our oyster fisheries, and thousands are consumed annually.

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SOME SNAILS OF THE OCEAN.

Cerithium aluco (East Indies).
Turbo petholatus (Indian Ocean).
Harpa nobilis (Philippines).

Haliotis assimilis (California).
Terebra lamarckii (Sandwich Islands).
Fissuridea listeri (U. S.)
Bulla ampulla (Philippines).

Crepidula fornicata (U. S.)
Littorina angulifera (U. S.)

Mitra pontificalis (Indian Ocean).
Nerita peloronta (Florida).
Strombus auris-dianae (Philippines).

SNAILS OF THE OCEAN

The Marine Snails outnumber all of the other mollusks, and their shells are far more beautiful, those in the tropics having the most gaudy colors imaginable. The animals are all formed on the same plan, although each family has some peculiarity not shared by its relatives. They are found in all parts of the world, and in all climates. While the majority of species live either between tides or near low water, there are not a few which live in the abysses of the ocean and have been dredged at a depth of three thousand fathoms, a distance of over three miles. The average depth at which mollusks are found in any number is about one thousand fathoms. The variability of marine snails is so great that only a few typical forms can be mentioned. (Baker.)

Haliotis, the abalone, or ear shell, is found in various parts of the world, but its greatest size and beauty are attained in the region of California. It is the source of the beautiful mother of pearl used in inlaying musical instruments and other valuable articles. The Indians and Aztecs restricted its use to royalty. The animal inhabiting one of these shells is considerably larger than the shell, a large, fleshy disc attaching it to the rock; irregular frills and tentacles, some of them bearing eye-spots, project from the surface, while water from the gills and waste pour through the perforations in the shell.

Crepidula, the slipper shell, or limpet, and *Fissuridea,* the keyhole limpet, are in habit similar to *Haliotis,* but

their range is greater and their size smaller. *Turbo* is the turban; *Nerita,* the bleeding tooth; *Harpa,* the harp; *Bulla,* the bubble; and *Cerithium,* the horn shell. *Mitra pontificalis* bears a more or less fancied resemblance to the pontifical mitre, or pope's cap. *Strombus,* one of the conchs, is frequently used for carving cameos, the shell layers of varying hues adapting it to this work. *Littorina,* the common periwinkle, is used in Europe as food, the fleshy animal being picked out with a pin; it is also used as bait for fishing, and when "planted" on oyster beds it keeps them clear of seaweed. (Shinn.)

THE NAUTILUS

The highest group of mollusks belongs to the class *Cephalopoda,* which signifies head-footed, the name being given to them because the head is surrounded by a circle of eight or ten arms, which act both as arms and feet.

The most familiar member of this class to the layman is the Pearly Nautilus, the shell of which may be found on the mantel shelf or what-not of very many dwellings. The shell of the nautilus is formed in a spiral and is made up of many chambers, all connected by a tube called a siphuncle, the outer chamber containing the animal, and hence called the living chamber. The shell is called the "pearly nautilus," but the pearly tints cannot be seen until the outer layer—which is yellowish-white with brown markings—is taken off, when the exquisite, rainbow-like colors may be observed.

While the shell of nautilus is well known the animal

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CEPHALOPODS.

Beak of Octopus.

Pearly Nautilus.
Nautilus umbilicatus (New Caledonia).

Paper Nautilus
Argonauta tuberculata (Indian Ocean).

is very rare in our museums, although the natives of the Fiji Islands, New Hebrides, and New Caledonia are able to obtain it in large quantities for food, and it is highly esteemed by them. During the voyage of H. M. S. Challenger around the world, a living nautilus was captured by dredging in some three hundred and twenty fathoms, near Mateeka Island, one of the Fiji group. This was placed in a tub and it swam about in a lively manner by ejecting water from its funnel. The tentacles, of which there are a larger number than in the other *cephalopods,* were spread out radially, like those of the sea anemone. The nautilus lives among the coral reefs, at depths varying from three to three hundred fathoms or more.

FRANK COLLINS BAKER.

MOTHS—½ Life-size.

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Phylampelus Achemon.
Sphinx chersis.
Smerinthus exaecatus.
Tritogon M[illegible]
Choerocampa tersa.
Phylampelus pa[illegible]
Coratomia amynton

CHAPTER II

THE INSECT TRIBE

In this chapter are pictured insects of various kinds. It will be recognized that all of them have a body which is somewhat elongated and which is made up of three portions: the head, bearing the eyes, the feelers or *antennæ,* and the mouth structures; the second portion, or thorax, bearing the legs, of which there are always three pairs, and the wings, of which there are almost always two pairs; while the third part of the body, called the *abdomen,* usually bears no very well marked structure. The kinds of insects illustrated in this chapter are: the *Lepidoptera,* or moths and butterflies; the *Coleoptera,* or the beetles; the *Orthoptera,* or grasshoppers; and the *Hemiptera,* or true bugs.

H. B. Shinn.

MOTHS AND BUTTERFLIES

Moths and Butterflies undergo complete metamorphosis; that is, after emerging from the egg, and before attaining the full development of the imago, they pass through the larva and pupa stages—the latter being one of total inactivity in so far as the outward manifestations of life are concerned. The eggs vary greatly in shape, and are deposited in a great variety of situations—on the under sides of leaves, on the outside of the cocoon, as in the Vaporer Moth,

the female of which is wingless; glued together in rings round the smaller branches of fruit trees, or in the interior of hives, the larvæ afterwards feeding on the wax, as in the Honey-comb Moth. They thus show a remarkable instinct in depositing their eggs in situations where the larvæ may afterwards obtain their appropriate food, although they themselves can have no knowledge of that food.

The caterpillar emerges from the egg usually in a week or ten days. Unlike the perfect insect, it is provided with a masticatory mouth. No sooner does the caterpillar emerge from the egg than it begins to eat voraciously, and in a few days it has grown so large that a change of skin is necessary. The old skin is cast off, and with it the entire internal lining of the alimentary canal, and in the majority of moths and butterflies five such changes take place before the caterpillar has attained its full growth, while the Tiger Moth is said to cast its skin at least ten times. Moths and butterflies remain in the larval condition for periods varying from three years, as in the Goat Moth, to a few weeks, as in the Cabbage Butterfly.

Having attained its full growth, the instincts of the caterpillar undergo a change; it ceases to eat and begins to weave a couch or cocoon, by which it is more or less enclosed. It then throws off its skin and appears as a pupa or chrysalis, incapable of eating or of locomotion. When mature, the pupa case cracks towards the anterior end, and the butterfly or moth crawls forth with wings which, though at first small and crumpled up, in a few hours attain their full size.

The male insect goes in search of the female, and when

213

Lifesize.

No. 1. Silkworm's eggs. No. 2. Full-grown worm. No. 3. Pupa in Cocoon. No. 4. Cocoon. No. 5. Male Moth. No. 6. Female Moth. No. 7. Unwinding Cocoon. No. 8. Raw Manufactured Silk. No. 9. Manufactured Silk.

the latter has deposited her eggs, the main object of the life of the imago is attained, and both sexes die.

A. E. B.

THE SILKWORM*

The Caterpillar, or Silkworm, is at first of a dark color, but soon becomes light, and in its tints much resembles the perfect insect — a circumstance common in caterpillars. Its proper food is the mulberry, though it will likewise eat the lettuce, and some few others plants, on which, however, it does not thrive equally well, and the silk yielded is of a poor quality.

The silkworm is about eight weeks in arriving at maturity, during which period it changes its skin four or five times. When about to cast its skin, it ceases to eat, raises the fore part of the body slightly, and remains in perfect repose. In this state it necessarily continues for a time, in order that the new skin, which is at this time forming, may become sufficiently mature to enable the caterpillar to burst through the old one. This operation is performed thus: The fore part of the old skin is burst; the silkworm then, by continually writhing its body, contrives to thrust the skin back to the tail and disengages itself; this is difficult, however, since it is no uncommon occurrence for them to die from not being able to free themselves.

When full grown, the silkworm commences spinning its web in some convenient spot, and as it does not change the position of the hinder portions of its body much, but continues drawing its thread from various points and attaching it to others, it follows that after a time its body becomes,

in a great measure, enclosed by the thread. The work is then continued from one thread to another, the silkworm moving its head and spinning in a zig-zag way, bending the fore part of the body back to spin in all directions within reach, and shifting the body only to cover with silk the part which was beneath it. In this way it encloses itself in a cocoon much shorter than its own body. During the time of spinning the cocoon the silkworm decreases in length considerably, and after the work is done it is not half its original length. At this time it becomes quite torpid, soon changes its skin, and appears in the form of a chrysalis. In this state the animal remains about three weeks; it then bursts the case and comes forth in the imago state, the moth having previously dissolved a portion of the cocoon by means of a fluid which it ejects. The moth is short-lived; the female in many instances dies almost immediately after she has laid her eggs; the male survives her but a short time.

Forty thousand eggs weigh about one ounce, and when hatched will produce about one hundred pounds of fresh cocoons.

THE CYNTHIA MOTH*

The Cynthia Moth is a native of India, China, and the adjacent islands, and has been domesticated as a source of silk in some provinces of China and India. The Cynthia moth has also been introduced into other countries, not classed as silk-producing districts. In both Europe and America it is easily reared and, it would seem, readily acclimated. Unlike the mulberry silkworm, the Cynthia is not seriously affected by exposure to moisture. In fact, a cer-

FROM COL. CP. W. E. LONGLEY.

CYNTHIA SILKWORM.
(Samia cynthia).
About Life-size.

tain amount of moisture seems necessary for its best development. An authority states that "the caterpillar drinks greedily," and he advises in the case of indoor culture that "the branches, when served fresh, should either be dipped in water or sprinkled abundantly, particularly after the third moult."

The Cynthia caterpillar feeds upon the luxuriant foliage of the Ailanthus, or "Tree of Heaven." It has a remarkable appetite, which seems to increase with the increase of the food supply. This is peculiarly observable toward the close of the caterpillar life, say, after the third moult, when the craving seems to be insatiable. The general color of the caterpillar is yellow, with transverse rows of small black spots, and the head is black. After it moults the first time the yellow color becomes more brilliant. After the second moulting the color becomes much lighter, and the third casting of its skin presents a creature with a white skin with black spots and yellow legs and head.

The cocoon is large and the thread is fine. Owing to the difficulty of dissolving the gum which is secreted by the larva to make the silken walls of the cocoon firm and strong, the silk is not easily unwound. It is, therefore, usually carded and the yarn is woven into a most durable silk cloth of a loose texture. English manufacturers have given the opinion that "the silk from the Cynthia may be made into shawls equal to the best India."

THE ATLAS MOTH*

India is not only noted for its large and ferocious beasts, but also for its gorgeous flowers and beautiful insects. Among these is the splendid Atlas Moth, noted not alone for the extravagance of its coloring, but also for its immense size, for it is the giant of the moths and butterflies. The largest specimen recorded is now in the British Museum. Expanded and measured from tip to tip of the fore wings, it is only one-quarter of an inch less than one foot. Measured in the same manner, the specimen of our illustration is a trifle over ten inches. The average expansion, however, is only about eight or nine inches. Its size influenced Linnæus to give this moth the specific designation of Atlas, the name of one of the Greek gods, by whom the pillars of heaven were supposed to be supported.

The larvæ or caterpillars of this regal moth are fully as interesting and beautiful as the adult insect. They have a long, thick, and fleshy body, which bears several rows of tubercles, crowned with spiny hairs. When young they are black with white spines, but afterwards become a rich green color and bear bluish-green or black spines. It is said that the larvæ eat their skins after moulting, and it has been suggested that the object of this habit is to prevent the cast-off skins indicating their presence to birds and other enemies.

The Atlas moth varies considerably in the color of its wings and, when compared with the expanse of its wings, its body is very short. A peculiar and striking character-

ATLAS MOTH (INDIA).
(Attacus atlas).
About ½ Life-size

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PROMETHEAN MOTH.
(Callosamia promethea.)

Adult Male.
Larva.

Pupa.

Adult Female.
Cocoon.

CECROPIAN MOTH.
(Samia cecropia.)

Adult Male
Larva.

Pupa.
Eggs on Maple Leaf.

Adult Female.
Cocoon.

About ½ Life-size.

istic is the large and triangular transparent spot near the center of each of the four wings.

Among its allies are some of the most important of the silk-producing moths of India, China, and Japan, and the common emperor moth of England. Other species of the genus *Attacus* inhabit Central and South America, but they are much smaller and not as beautiful as the Atlas.

THE CECROPIA AND PROMETHEA MOTHS

The Cecropia is our largest and to many persons the best-known moth. Its gigantic size, varying from about four to seven inches in expanse of wings, together with its bright colors, makes it an easily remembered insect. The time of active flight is at night, and thus it is that they are so frequently found in numbers about electric lights, to which they have been attracted by the intense light. Their rather awkward flight and large size often lead to their being mistaken for bats.

The differences between the sexes are not so manifest as in Promethea, yet it is not difficult to distinguish them. The females are larger and have stouter bodies, but the most conspicuous difference is that the "feelers" or antennæ of the male are feather-like and very large and broad, while those of the female are only about one-half as broad.

The eggs are somewhat flattened, about one-tenth of an inch long, pale in color, and are deposited by the female in small patches upon a large variety of plants, since there are about fifty of these upon which the larvæ will feed.

The Promethea Moth is only about one-half the size of

Cecropia, and the two sexes are very different in appearance — so much so that one would not at all think they were the same kind of moths. As in Cecropia, the male moths are somewhat smaller than the females, and the antennæ show the same kind of differences, *i. e.*, the antennæ of the males are much larger and feather-like. In color, the sexes of Cecropia are much alike, but in this moth the differences in color are very great, the dominant color in the female being a reddish-brown, while that in the male is a very dark brown or almost black. Thus these moths furnish an excellent illustration of what is called sexual dimorphism, a term used for those animals in which the sexes are very different in appearance, a subject to which Charles Darwin gave considerable attention, in his "Descent of Man."

The female moth lays her cream-colored eggs, which are a little smaller than those of Cecropia, upon shrubs and trees in clusters of five or six. The small larva usually hatches in about ten days, and feeds upon the leaves of ash, sassafras, lilac, tulip tree, maple, cherry, and a number of other trees and shrubs, but it is much more select in the choice of its food than Cecropia.

Charles Christopher Adams.

THE LUNA AND POLYPHEMUS MOTHS

Luna.— During April or May the mother moth lays her dark brown or chocolate-colored eggs upon hickory, walnut, beech, oak, and a few others of our forest trees. The number of food plants is doubtless one reason for the

LUNA MOTH.
(Tropaea luna.)

Adult Male.
Larva.

Pupa.

Adult Female.
Cocoon.

POLYPHEMUS MOTH.
(Telea polyphemus.)

Adult Male
Larva.

Pupa.
Eggs on Maple Leaf.

Adult Female.
Cocoon.

About ½ Life-size.

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rarity of the moths, as compared with such a common and almost omnivorous larva as Cecropia. A single moth may lay about one hundred eggs, which are smaller than those of Polyphemus. These hatch in about ten to fifteen days, the larva making its escape by eating a circular hole in the shell. Occasionally a young larva may be seen crawling about for a short time, carrying upon its head or tail the empty shell.

The adult larva is about three inches long, of a delicate pale green, a color very difficult to preserve in the dead larva. Those on the plate have lost this delicate green, and have become yellow, but show the form perfectly. This larva is very much like that of Polyphemus, but may be distinguished from it by possessing a longitudinal pale yellow lateral line, which is not found in Polyphemus.

Polyphemus.— The life history of this native silkworm is by far the best known, because many years ago it was very carefully studied, with the hope that it would prove an important silk insect. This hope, unfortunately, has not been realized.

The moths, as shown by the plate, are really beautiful; the large eye spots on the hind wings contributing much towards this effect. The transparent, window-like centers in the eye spot are also of quite rare occurrence among our moths. These transparent areas do not possess the very minute scales found on the other parts of the wing. Almost all of the wonderful variety of colors found in the wings of butterflies and moths are due either to coloring matter in these scales, or to the breaking up of the white light by minute lines on these scales, such as are seen in the play of

colors on a soap-bubble. These fine lines on the scales are only on the upper side, and are about one sixteen-thousandth of an inch apart.

The eggs of Polyphemus are very much flattened, about the size of those of Cecropia, and are deposited on leaves and twigs singly or in small groups. These hatch in about ten days and usually in the morning. The young larva often devours the shell which a few moments before afforded it shelter. This larva feeds upon oak, hickory, apple, maple, elm, and a variety of other trees.

CHARLES CHRISTOPHER ADAMS.

THE BUTTERFLY

In the western part of England, the first butterfly you see in the spring is white, and if you succeed in killing this butterfly, good luck will surely come to you. Some gentlemen on their way to church one day saw a friend dashing down the road, wildly brandishing a cane. He could not stop to explain. He was as a rule a sedate, calm man, so this excitement alarmed them. As nothing could be done, they went on their way, and soon met the father of their friend, an old man who usually hobbled painfully along on two canes. He, too, was excited and was doing his best to make his way down the road with only one cane. His first words were, "I'm afraid he has missed it." "Missed what?" thought the gentlemen, and finally, after many efforts to quiet him enough for conversation, they learned from the old man that his son had seen his first butterfly, that it was white, and that without more ado he had snatched his old

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BUTTERFLIES

father's cane and set off in pursuit. Still the old man was perfectly willing to hobble along as best he could if only good luck and prosperity could be procured by the slaughter of the pretty little insect. The color of its wings is due to what seems to us a fine dust scattered over them, but in reality this dust is made up of little discs fastened by stalks to the wings, arranged usually in rows somewhat like the shingles on a house.

Notice its two great round eyes, and remember that each of these is composed of thousands of perfect little eyes. Its trunk you will find coiled up under its head, and sometimes this butterfly of ours completes its toilet by opening its trunk and cleaning it. By the antennæ of the butterfly you can tell it from the moth, for those of the former are immovable and furnished with knobs, while those of the other have not the knobs and can be stowed away under the wings. If you wish to distinguish the butterfly from the moth, remember this fact, and also that butterflies fly only in the daytime and always rest with the wings erect. These facts are trustworthy, for no moth has ever been found to possess all three of these characteristics, though some do possess one or two.

Though curious in itself, its life history is still more curious. Man, in passing through his seven ages, never loses the distinguishing characteristics which make him a man; but our butterfly, as it passes through its three ages, changes so much that we seem while studying it to be studying three distinct creatures—the Caterpillar, the Chrysalis, and the Butterfly.

In the caterpillar our dainty little fairy presents itself

as it appears in its first stage, having just spent a few days, or a month, or perhaps the whole winter, in the egg. It changes its old skin many times during its caterpillar life of twenty or thirty days, at each change gaining in weight and brilliancy, until with the last it appears as a chrysalis, "a legless, mummy-like creature," which maintains its suspended position by means of the hooks on its tail or by a silken girth around its body. A few days before the butterfly comes forth, it can be seen through the thin cases. Finally the skin on the back bursts open and the little insect is free. For a few minutes it stands with drooping wings. Gradually the wings distend and in a short while reach four times their original size. Then our butterfly hastens away to carry its joyful greeting to man and flower.

So the cycle of butterfly life can thus be indicated: Egg, Caterpillar, Chrysalis, Butterfly, Egg.

Why they migrate is not known, but evidence enough has been brought in by eye-witnesses to prove that this does occur. One flight seen in Switzerland lasted for two hours, the continuous stream of insects being ten or fifteen feet wide, and made up of the species called the Painted Lady. Similar companies have been seen at sea, as Mr. Darwin bears witness, also before and after tornadoes in certain places.

In Ceylon a gentleman drove through a cloud of white butterflies for nine miles. But very interesting to us is a great migration recorded to have been seen in our country, in Massachusetts, about October 1, 1876. These are strange stories, but really hardly more strange than

other facts about these little animals, graceful and beautiful in form and motion, whose very presence adds greatly to the charm of Mother Nature.

Such quantities of eggs are laid by the butterflies that if certain animals did not contend against them, man would not be able to withstand the ravages of the caterpillar. Man has one powerful ally in the birds, which devour enormous quantities of these eggs, but a still more powerful ally is the Ichneumon Fly. This little insect is a parasite through its grub state, and chooses as its host either the egg of the butterfly or the caterpillar. The full-grown fly lays its egg by means of an ovipositor, a sharp, hollow instrument with which it can pierce the skin or shell of its victim. The eggs of the fly hatch and the grubs feed upon the caterpillar, but usually do not touch upon its vital parts until it is full grown; then they devour them and within the skin of their former host form their own cocoons. Sometimes they wait until the caterpillar assumes its chrysalis state before they finish their dread work; then, much to the surprise of interested beholders, a little cluster of flies appears at the breaking of the cocoon, and no beautiful butterfly.

Some of these brightly colored little messengers of gladness live through the winter. Usually they pass this trying period wrapped warmly in the cocoon or nestled under some leaf, still a chrysalis; but a few species weather the cold and the snow and, shut up in some hollow tree or some empty shed, sleep away the happy days of Jack Frost and Santa Claus, and are ready to awake with the spring, when they are not abashed in their bedraggled garments to

appear among their brothers who come forth brightly clad, fresh from the soft, warm resting place of the cocoon.

Perhaps the marvelous migration of butterflies which occurred on October 3, 1898, will be more interesting to us than those already mentioned, because it happened so recently, and in our own country, and perhaps, most of all, because the reason for flight is hazarded. The inhabitants of Wichita, Kansas, at 3:15 o'clock in the afternoon of that day, were greeted with the sight of many butterflies flying south. Gradually the number increased until business practically ceased, the inhabitants all turning out to view the brilliant spectacle. The stream of yellow and brown insects, with the accompanying purr and brilliant effects of fluttering wings, flowed on until within a half hour of sunset, and even after this millions of stragglers hastened southward. But you are interested in the reason given? They say our little friends were driven away from their customary haunts by the forest fires in Colorado. This is only one more supposition to add to the list already awaiting some enterprising student who shall at last solve the mystery of these wonderful flights and fully acquaint us with all the other interesting facts which our little butterflies are still keeping secret.

EMILY C. THOMPSON.

BUTTERFLIES

In this plate the two forms *Papilio* are examples of the large group of Swallow-tail Butterflies, various members of which are found throughout the United States and Canada. The forms *Terias* are "small Sulphur Butterflies," the

BUTTERFLIES. Lifesize.

Papilio Ulysses.
Papilio Memnon.
Megaleria Orithyia. (Female.)

582

MILKWEED BUTTERFLY.
(Anosia plexippus).
About Life-size

nicippe, common in the United States south of the Ohio River, while *Mexicana* occurs in the Southwest and in Mexico. *Meganostoma* is the "Dog-face Butterfly," common on the Pacific coast. *Colias,* in this plate, is one of the "Clouded Sulphur Butterflies," which is common throughout the United States east of the Rocky Mountains, in meadows, fields, and roadsides; it develops from a small green caterpillar which is frequently found on clover. *Junoiana* is a "Peacock Butterfly" which is very common in the Southern States and even as far south as South America. *Limenitis* is a "Red-spotted Purple Butterfly," a common form, recognized by the blue spots on the upper sides of the black wings and by the red spots underneath.

H. B. Shinn.

THE MONARCH OR MILKWEED BUTTERFLY

This beautiful butterfly takes one of its names from the milkweed *(Asclepias),* a genus of common yet attractively flowered plant, upon the leaves of which its larvæ feed. It is one of our most common butterflies, is quite hardy, and probably produces several broods each season.

It is generally believed that this species is migratory, in the fall traveling southward in swarms, and returning in the spring. It lays its eggs on the leaves of the various species of milkweeds. These eggs soon hatch tiny larvæ, or caterpillars, which begin to eat at once and grow rapidly. During the period of its existence as a larva, which is about ten days, it remains contentedly on the same plant, only moving in order to obtain a new supply of food, or to seek

shelter from storms or the burning rays of a hot sun. While in the larval form, it moults or sheds its skin five times. After the fifth moulting it becomes more restless and moves up and down the stem of the plant, or may even leave it, going to some other plant or object, such as a fence. Very soon it attaches itself with a sticky substance, and forms a beautiful chrysalis, which resembles clear green china, ornamented with gold spots. The chrysalis hangs for about twelve days, when it changes to a darker color and soon breaks, releasing the full-grown butterfly. There are four stages in the development of the butterfly: first, the egg, which is laid on the leaf of the milkweed; second, the larva, which feeds upon the leaves of the plant; third, the resting period in the chrysalis, where the larva is changed into the adult butterfly; and fourth, the adult stage, which may be either male or female. With the exception of the first stage, all are illustrated on our colored plate.

MARY E. MURPHY.

BUTTERFLIES OF THE TEMPERATE ZONE

Argynnis is the Ruddy Sulphur-spot, common in the northern United States in late summer; it is distinguished by its rather large size, its ruddiness above, and its numerous spots of sulphur on the under side of the wings. *Vanessa,* the Mourning Cloak, is usually about one and three-fourths inches in breadth, and is common throughout the United States. The caterpillars of the mourning cloak are commonly found on willow, elm, or poplar trees. *Danais* is the Monarch or Milkweed Butterfly, which is common

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Argynnis Aleestis
Rhyeniodes Nycteis.
Colias Eurytheme
Meganiostoma Caesar

Danais Archippus

Vanessa Antiopa.
Pieris Protodice.
Danais Portlandia.
Danais Hamata.

in the northern United States; it perhaps deserves especial mention because it is one of the few insects which migrate in the fall and spring. On sunny days of late summer, many a boy and girl has noticed large numbers of these butterflies clustered thickly upon the branches of trees along the roadsides or in the weeds, where they are gathering together for their fall migration southward. They have even been met with several hundred miles out at sea. The return journey in the spring is not made by members of one generation, but the first generation, reaching the southern United States. The product of these eggs flies northward considerable distances and again reproduces and dies. This accounts for the appearance of these butterflies in large numbers in the region of Wisconsin and Michigan only during August and September, for they are the third or fourth generation. *Phyciodes,* the Northern Crescent-spot, is common in the northern United States as far west as the Rocky Mountains. *Pieris,* or *Pontia,* is a common White Cabbage Butterfly; the northern species is *rapæ,* and the southern *protodice.* *Colias* is one of the sulphurs; *Debis* is the Pearly-eyed Nymph, a woodland form which is rare west of the Rocky Mountains. *Meganostona sæsonia,* the Southern Dog-face, is usually about two and one-quarter inches broad, and is found in the Southern States. *Pyrameis huntera,* Hunter's Butterfly, or Painted Beauty, is usually about two inches broad, and is found east of the Sierra Nevada Mountains. H. B. Shinn.

A NEW ARGYNNIS OR SILVERSPOT BUTTERFLY

The butterfly to which I want to introduce you is a rare beauty! It is called *Argynnis nitrocris nigrocærulea* by scientists, but the young people of our school call it the Blue-black Silverspot, or the Sapello Fritallary. They wanted very much to name it after the State, but unfortunately there is a butterfly of this genus that bears the name of New Mexico Silverspot.

Every member of the genus *Argynnis* is beautiful, and it is a great treat to see the glint of the silver-dotted wings of these butterflies as they hover about the gaily colored flowers in some mountain canyon or Alpine meadow. But no member of the genus will compare in beauty with the female of the *nigrocærulea,* and I should find difficulty in forgetting the pleasure I felt in seeing two of these lovely creatures sucking the nectar from a large, bright-colored Rudbeckia.

The *nigrocærulea* is very much like a silverspot that is found in the mountains of Arizona; both belong to the species *nitrocris,* and there is still a third form found in the mountains of Mexico.

The *nigrocærulea* was discovered in August, 1900, in the Sapello Canyon, a beautiful canyon in the Rocky Mountains, near Las Vegas, New Mexico. The male is reddish-fulvous on the upper surface, with well-defined markings consisting of waved transverse lines and crescent-shaped spots. On the under side the design of the fore wings is somewhat indistinctly repeated, and the base is

SILVER-SPOT BUTTERFLY.
(Argynnis nitocris nigra-caerulea).
Life-size.

Female, upper surface
Male, upper surface

Female, under surface.
Male, under surface.

518

LEAF BUTTERFLY (INDIA).
(Kallima paralekta.)
Life-size.

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colored with a most exquisite reddish-pink. The under surface of the hind wings is a rich brown with a wide yellow border, and is profusely marked with spots of glistening silver. The female on the upper side is bluish-black, well marked near the margin by large spots of yellow suffused with blue. The under surface is very like that of the male, though the colors are more pronounced, the brown in the hind wing merging into black.

WILMATTE PORTER COCKERELL.

LEAF BUTTERFLY (INDIA)

This plate illustrates what is known as the Dead-leaf Butterfly of India, where it is very common. The lower figure illustrates the insect as viewed from above with its wings outstretched, and the upper right-hand figure shows the same butterfly with its wings folded over its back so that the under surfaces only are seen. The very close imitation of a dried brown leaf is the animal's protection, for it escapes notice through this specialization of color and form. While it illustrates such protection very well, there are equally good examples in every locality, if the boy or girl has eyes to see them. It must not be supposed that the butterfly in this case has calmly seated itself upon some branch, scratched its head, and calculated that if it should only imitate a dead leaf closely it would save its life, and, having so concluded, straightway has changed itself and arrived at the present condition. On the contrary, it seems much more probable that in preceding generations some individuals happened to look somewhat like a dead leaf

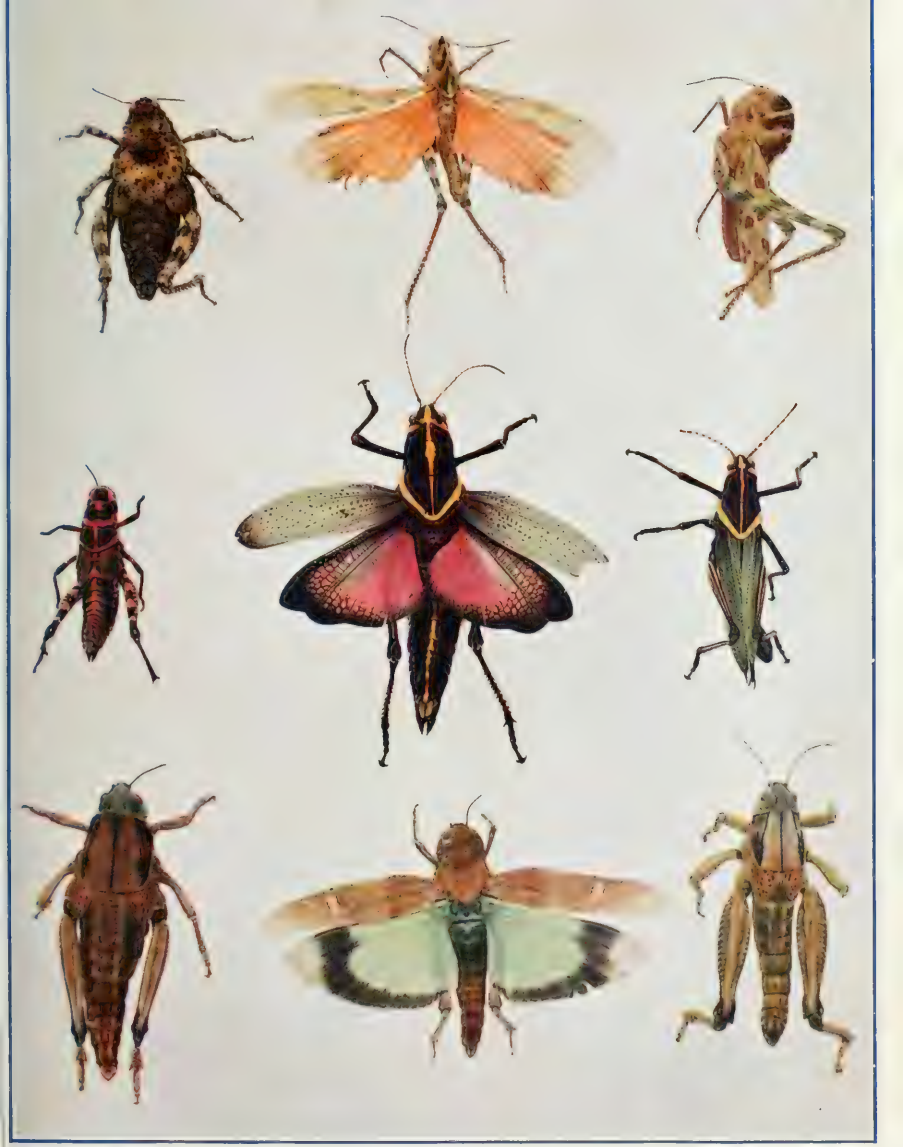
and thus escaped notice, while the brothers and sisters were eaten by the birds or lizards. The ultimate result has been the reappearance and the fixity of this form and the non-appearance of any other. We are all familiar with examples of such variation in a brood of chickens, a litter of kittens or puppies, or even among the children in a human family. H. B. Shinn.

THE GRASSHOPPERS*

The Grasshoppers belong to that order of insects called the *Orthoptera,* a name derived from two Greek words meaning *straight* and *a wing.* The name is very appropriate for this group of insects, for the wings, when in repose, are laid against and lengthwise of the body. There are two pairs of wings, which are more or less developed, though in some species they are wanting. The insects of this order may be divided into two classes: the running *Orthoptera,* which includes the cockroaches, earwigs, walk-sticks, and walking-leaves; and the leaping *Orthoptera,* to which group belong the grasshoppers, locusts, and crickets.

The common grasshoppers which frequent meadows, pastures, and roadsides are known as the short-horned forms, and belong to the family *Acridiidæ,* a word derived from the Greek diminutive meaning little locusts. They possess the four pairs of wings, the inner two being membranous and used in flying, and the outer two coarser, and simply a covering for the more delicate inner pair.

The call notes of the grasshoppers, which are only made by the males, are produced in two ways. "In one group,



FROM COL. CHI. ACAD. SCIENCES.

Phrynotettix tschivavensis (Female).
Dactylotum variegatum (Male).
Brachystola mexicana (Female).

GRASSHOPPERS (Mexico).

Tropidolophus formosus (Male).
Taeniopoda picticornis (Female).
Leprus elephas (Male).

Tropidolophus formosus (Female
Taeniopoda picticornis (Male
Brachystola mexicana (Male

Lith.

COMMON AMERICAN GRASSHOPPERS.
Life-size.

Hippiscus neglectus.
Dissosteira carolina.
Arphia tenebrosa.
Schistocerca americanum
Melanoplus differentialis
Hippiscus tuberculatus.

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whose members call only when at rest, the sound is produced by rubbing the inner surface of the hind femur against the outer surface of the wing covers. In a second group the call notes are usually produced during flight by rubbing together the upper surface of the front edge of the wings and the under surface of the wing covers."

There is another family of grasshoppers *(Locustidæ)*, which includes the long-horned species or katydids. They are green in color and have very long antennæ; are more delicate and fragile than the short-horned species, and are notable singers.

COMMON GRASSHOPPERS

The Grasshoppers are the most common, as well as the best known, popularly, of the great branch of insects. They may be seen in every field, in the forest, by the roadside, and even in our city yards. In the hot month of August the "song" of the locust may be heard, at which time we are told by the farmer-naturalist that "we shall have a spell of hot weather."

The best-known grasshoppers belong to the family *Acridiidæ*, which comprises the forms with short antennæ or "horns." Our illustration shows six of the common grasshoppers, all inhabiting the northern part of the United States.

The coral-winged locust *(Hippiscus tuberculatus)* is common in the early spring, when it appears in considerable numbers. It has been mistaken by farmers for the terrible Rocky Mountain locust, and has been called by them the

King Grasshopper. *Hippiscus neglectus* is a related species, but is smaller, with more pronounced colors.

A most familiar grasshopper is the Carolina locust *(Dissosteira carolina),* which may be collected abundantly from July to October or November.

One of the most familiar of the smaller grasshoppers is *Arphia tenebrosa,* allied to the yellow-winged locust *(Arphia sulphurea),* but with red instead of yellow wings.

The grasshoppers or locusts most dreaded by the agriculturist are the truly migratory species, belonging to the genus *Melanoplus.* To this group of insects belong the Rocky Mountain locust *(Melanoplus spretus),* and its relative *Melanoplus differentials,* which is the largest species of the genus living in the northern part of the United States.

Probably no problem has arisen to so vex the agriculturist as the one caused by the depredations of these seemingly insignificant insects. COLLINS THURBER.

DRAGON-FLIES

In April the larvæ of the Dragon-flies begin to crawl forth from their dark, muddy haunts on the bed of the brook and the edges of the pond. Here they have lived for a year, perhaps more, creeping about in the slime at the roots of the water weeds, seizing and devouring the snails, tadpoles, and minnows. All the aquatic insects that come within reach of their sharp-pointed claws fall victims to the insatiable hunger of the larvæ. They are very slow-moving creatures in this stage of their lives, and often remain

Libellula pulchella.
Libellula basalis
Celithemis eponina.

AMERICAN DRAGONFLIES.
Life-size.

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Calopteryx dimidiata.
Calopteryx maculata
Hetaerius americana

motionless for hours, or scull themselves leisurely through the water by bending their bodies from side to side.

During this dark, sluggish stage of the dragon's life he changes his skin several times, but there is no hint in his dull-colored garments of the wonderful shining robes he is finally to don. When the time for the last change approaches, the rudiments of wings appear on his back.

This larva is a stranger to that long, mysterious sleep in which so many members of the insect world indulge. He spins no cocoon; he does not bury himself in the earth nor hang his chrysalis above the stream. When an inner impulse tells him that the time has come for his old life to end, that a new, freer existence awaits him, he creeps slowly upwards towards the sunlight and the air, toward that bright world in which he is to live hereafter. When he emerges from the larval skin, his body is limp, his wings wet and folded like a fan. The warm sunshine soon kisses them to strength and they grow brilliant and clear as they dry. A half day is often required to prepare them for flying.

One of the dragon's early peculiarities remains unchanged — his voracious appetite. As soon as he finds himself able to fly, he begins to chase mosquitoes, the gnats, and all manner of little winged creatures. He fills his mouth until it will hold no more, then lights on a sunny rock or a swaying water weed to masticate at leisure.

Each day from April to mid-October the dragon larvæ creep upwards, burst their skins, and fly forth, decked in every color of the rainbow. Last summer I watched them by the little trout brook where I fished for ninety consecutive days. First came the brown ones with short, thick

bodies and glistening wings; next, a beautiful red variety with bodies that glowed like rubies. Next in the procession appeared the flies with clouded wings and frost-dusted bodies, followed by the largest and most powerful flier among them all, with his mosaic of yellow, blue, white, and black, and his enormous compound eyes, glistening like jewels. MARGARET WENTWORTH LEIGHTON.

BEETLES

Beetles *(Coleoptera)* are the most easily distinguished of all insects, inasmuch as their bodies are almost entirely enclosed within a hard shell. The outer pair of wings carry out this armor-plate idea, being inflexible and usually shiny. In taking up the species illustrated in the order of their occurrence in the picture, more than a word regarding most of the forms cannot be given here; such would be the work of a technical treatise. All of those forms figured in the first row across, with the exception of *Brenthus,* belong to the large group of hunting beetles which, in both the adult and larval stages, prey upon other insects. *Libia* preys upon potato "bugs"; *Alaus,* the Eyed Elater, has the startling habit of clicking its thorax against the abdomen and thus snapping itself away from its captor. Its larva bores in wood. The other forms pictured in this row are predaceous *Necrophorus,* being called Burying Beetles, or Tumble Bugs. In the next series, *Calosoma scrutator* is called the Searcher, or Caterpillar Hunter, because of its nocturnal habit of hunting and feeding upon the hairy caterpillars found upon foliage. *Calosoma calidum* is the

BEETLES.

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Fiery Hunter. *Cotalpa* is the Goldsmith Beetle, feeding, for the most part, upon foliage. *Cychrus* is another of the hunters. In the last series *Lucanus* is the Stag Beetle of the South; its food is the sweet sap of trees and the honey dew of certain plant lice. *Cynastes* should be named *Dynastes;* it is the Rhinoceros Beetle of the South; it is a burrowing form which feeds for the most part upon animal tissues. The horned *Passalus* is similar in habit to the *Lucanus;* it is one of a number of so-called Pinch Bugs.

H. B. Shinn.

INSECTS

Because on this plate the forms are not named, let us give them numbers from one to twelve, counting from left to right in the successive rows. Number 1 is *Archimerus calcarator,* a relative of the squash bug and the box elder bug, two forms which are highly injurious through their habit of piercing the soft tissues of plants and withdrawing the sap, to the detriment or destruction of the plant.

Number 2 is a tree bug, *Nezara nilaris,* which is found in the South upon orange trees; it is a true pest, and is one of the numerous "stink bugs."

Number 3 and number 5 are leaf-footed plant bugs, the first being *Metapodius femoratas,* the cherry bug, and the latter, *Leptoglossus phyllapus,* a form affecting oranges, while a Northern form injures melons and garden stuffs.

Number 4 is *Oncopeltus fasciatus,* a milkweed bug, which is a close relative of the "Cotton Stainer," a particularly obnoxious insect in cotton fields, where it stings the

growing cotton boll, thus checking its growth, and later, as the boll is opening, stains it with its excrement.

Number 6 is *Conorhinus sanguisuga,* one of the types commonly called assassin bug, or kissing bug; in the South it sometimes enters houses and pierces human flesh, injecting into the wound its own saliva; this causes a painful swelling. The young are sometimes found in the crevices in the walls and floors, covered with dust which adheres to the sticky surface of their bodies and enables them to steal upon their prey unseen. They are called "bedbug hunters," and they do great benefit by attacking other insects which are injurious.

Number 7 is the Water Scorpion, *Ranatra,* a "beast of prey" which is found in the mud and weeds of shallow water; it attacks other animals. Its form and color are protective.

Number 8 is *Benacus griseus,* the Giant Water Bug, a common aquatic form which is very ferocious in habit, not hesitating to attack turtles and fish. At night it frequently leaves the ponds and flies about, often being attracted by lights; for this reason it is sometimes called the "electric light" bug. It is one of nature's scavengers and also one of her means of keeping the animal population in check.

Number 9 is *Cicada septemdecim,* the Seventeen-year locust, distinguished as in the picture by the red veining of the wings. This insect deposits its eggs in slits in the bark of young twigs. The eggs hatch within a few weeks, the young forms drop to the ground and burrow some distance until they can feed upon the juices obtained from various plant roots. Every two or three years they moult.

In the spring of the seventeenth year they crawl to the surface of the ground, up upon some support where the skin, or "shell," is cast off ; the adult insects now spread out their wings to dry, and fly away. A similar form which develops in two years is found in the North, where it is called the "Harvest Fly" ; its strident song is common in the days of late summer.

Number 10 is the Toad Bug, *Galgulus,* which occurs in water, and feeds upon the blood of animals, either dead or alive.

Number 11, *Platycotis,* the Tree Hopper, is one of a large number of little brown bugs which are very common upon the bark of trees, where their color and their form protect them. They are sap feeders, but are held in check by such birds as the creepers and nuthatches, which make it a business to hunt them. H. B. Shinn.

CHAPTER III

THE FISH TRIBE

THE group of fishes, while a very large one and including many very different forms, has certain characteristics distinguishing it from all others. The entire life of a fish is spent in the water; it has fins; fingers and toes never develop; and it undergoes no marked changes which would tend to simplify its structure. This statement explains why a tadpole is not a fish. Many creatures which by fishermen or sailors are frequently miscalled fishes really have no claim to be so named; a seaman calls any animal which lives in the water a "fish"; as cuttlefish, devilfish, shellfish, etc. etc.

H. B. SHINN.

THE FISH'S PLACE IN NATURE

Some animals have their hard parts on the outside. These may be a horny coat or skin, such as the beetle has, or a double shell, like the oyster's, or a single shell, like the house of a snail. Or they may be a hard crust, like the lobster's coat of mail, or a brittle crust, like the sea-urchin's, or with tough nodules on a leathery hide, as in the starfish, or any one of a hundred variations from these. But in all such cases there is no backbone, no true skeleton, and no real skull.

Then there are a host of animals that have their hard

parts on the inside. When this is the case, the animal has a regular head, generally with a skull inside to protect the brain from hard knocks.

Then behind the skull is a backbone made up of a number of separate joints of bone. To the skeleton other bones are attached to help the animal to move himself about on land or in the water. Sometimes these bones grow out as legs, with toes and claws at the tip of them. Sometimes they take the form of wings, or they may spread out into flat paddles or oars of one kind or another, and these we call fins. What shape the parts take depends on what the animal does with them, for every kind of beast is built with direct reference to his business in life.

The backboned animals are the highest of all the animal kingdom. That is, in general they can do more things, they have a greater variety of relations to the things around them, and they are more definitely fitted for a high position. Some of them are not very high nor very intelligent, even as compared with their lower brethren, the insects. The ant is a tiny creature, with no skull and no backbone, and cannot do any very big thing; but she is a very wise beast by the side of a carp or a herring. Still, on the whole, the backboned animals are the highest, and as you and I both belong to that class, we could never afford to confess to any doubts as to their superiority.

But we are the highest of the type — that is, we men — and the rest of the tribe are all lower. And the lowest of all backboned animals we call fishes. And we shall know a fish when we see one, because the hard parts or skeleton are on the inside, and he stays in the water, breathing the air

COMMON SUNFISH.
Life-size.

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which is dissolved in it, and he has never any toes or claws or feathers. He breathes with gills and he swims with fins. He has no hair or feathers on his body, and when he has any cover on his skin at all, it takes the shape of scales. A fish is a water backboned animal. A backboned animal is called a vertebrate. A fish is therefore a water-vertebrate.

There were fishes before there were any other kind of vertebrates. They have been on the earth longer than birds or beasts or reptiles. They came first, and we have good reason to believe that the fishes are the ancestors of all the others.

But when the forefathers of the land animals found means of keeping alive on the land, so many new opportunities opened out to them, and they found so much variety in their surroundings, that they throve and spread amazingly. And there came to be many kinds of them, of many forms, while the rest of the tribe kept in the water and stayed fishes.

And there was always a host of these, and nearly all of them had fishes for their food. So they fought for food and fought for place. Those who could swim fastest got away from the rest, and those who could move quickest got the most to eat. Those with the longest teeth were present at the most meals, and those with the biggest mouths dined with them. And some escaped because they had hard, bony scales, too tough to crack. Some were covered over with thorns, and some had spines in their fins, which they set erect when their enemies would swallow them. And some had poison in their spines and benumbed their enemies, and some gave them electric shocks. Some hid in crevices of

rock, or bored holes in the mud, and lay there with their noses and their beady eyes peeping out. Some crawled into dead shells. Some stretched their slim, ribbon-like bodies out in the hanging sea-weed. Some fled into caves, whither no one followed them, and where they lay hid for a whole geological age until, seeing nothing, they had all gone blind. And some went down into the depths of the sea — two miles, three miles, five miles. I have helped haul them up to the light, and these went blind like the others, for the depths of the sea are black as ink and cold as ice. And even there they are not safe, for other fishes go down there to eat them. And some carry lanterns, large, shining spots on their heads or bodies, sometimes like the headlight of an engine. And with these flashing lanterns, these burglars of the deep hunt their prey. And these are hunted by others, fish-hungry, too, who lurk in the dark and swallow them, lanterns, headlight and all!

And so, with all this eating and chasing and fighting and fleeing and hiding and lurking, it comes about that wherever there is decent water on land or sea there are fishes to match it. And every part of every fish is made expressly for the life the fish has to lead. If any kind failed to meet requirements, other fishes would devour and destroy it. So only the fit can survive, and these people the water after their kind.

All kinds of fishes are good to eat except a few which are too tough, a few which are bitter, and a few that feed on poisonous things about the coral reefs and so become poisonous themselves. Some are insipid, some full of small bones and some are too lean or too small to tempt anybody,

unless it be another fish. But this is their business, not ours, and they have flesh enough for the things they have to do.

The biggest fish is the great basking shark, which grows to be thirty-five feet long, and lies on the surface of the sea, like a huge saw-log, filling its great mouth with the little things that float along beside it.

The smallest of all fishes lives in the Everglades of Florida and the streams that run out of them. You can find them in the little brook that runs through Jacksonville. I have netted them there with a spread umbrella, which will serve when you cannot get a better dip-net. They are prettily barred with jet black on a greenish ground, and they belong to that group of top minnows to which Agassiz gave the name of *heterandria*. It is hard to say what is the highest fish — what is the one which has undergone the greatest modification of structure. Perhaps this place should be assigned to the sole, with its two eyes, both on one side of the head, peering through the same socket, while the socket on the other side has no eye at all. Or perhaps we may place as highest some specialized form as the angler or sargassum fish, which has the paired fins greatly developed almost like arms and legs, and which has a dorsal spine modified into a fishing rod, which has a bait at the end, hanging over the capacious mouth.

Agassiz put the sharks higher than all these bony fishes because, while lower in most respects, the sharks have greater brain and greater power of muscle. Others, again, might give the highest place to the lung fishes, fishes of the tropical swamps, with lungs as well as gills, and which can

breathe air after a fashion when the water is all gone. These are not high in themselves, but they are nearest the higher animals, especially interesting to us because from such creatures in the past all the frogs and salamanders, and through these all the beasts that bite, the birds that fly, and the reptiles that crawl, are descended. These are near the primitive fish stock, the ancestors of true fishes on the one hand and of the land vertebrates on the other. As such, they partake of the nature of both. More correctly, their descendants have divided their characters. Their land-progeny lost the gills, scales and fins of the lung fishes, while their water descendants have lost their lungs, or, rather, the use of them, for the lung of the fish is generally a closed sac, called the air bladder. Sometimes it is only partly closed, and sometimes it is lost altogether.

But while we may dispute about the highest fish, there is no doubt about the lowest one. This is the lancelet. It is of the size and shape of a toothpick, translucent, scaleless, and almost finless, burying itself in the sand on warm coats, in almost every region.

The lancelet has no real bone in it, just a line of soft tissue blocking out the space where the backbone ought to be. It has no skull, nor brain, nor eyes, nor jaws, nor heart, nor anything in particular — just transparent muscle, spinal cord, artery gills, stomach and ovaries, with a fringe of feelers about the slit we call the mouth. And even these organs are rather blocked out than developed, yet it is easy to see that the creature is a vertebrate reduced to their lowest terms.

You can go fishing almost anywhere, but whether it is

SPECIMEN LOANED BY RUDOLF HAMAN.

COMMON GAR PIKE.
(Lepisosteus osseus).
$\frac{1}{5}$ Life size.

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good to do it or not depends on your reasons for doing it. There are about three good reasons for going a-fishing, one indifferent one, and one that is wholly bad.

One good reason is that you may learn to know fish. Isaac Walton tells us that "it is good luck to any man to be on the good side of the man that knows fish." This is true, but you cannot learn to know fish unless you go forth to find them. There are about 15,000 kinds of fish in the world; 4,000 of them in North America, north of Panama. Now no man knows them all, not even on one continent, though some have written books upon them.

But the man who knows a large part of them has not only learned fish, but a host of other things as well. He calls to mind rosy-spotted trout of the Maine woods, and still rosier of many brooks of Unalaska. He has seen the blue parrot fishes of the Cuban reefs and the leaping grayling of the Gallatin and the Au Sable. He has tried the inconnu of the Mackenzie River and the tarpon of the Florida reefs. He knows the sparkling darters of the French broad and the Swannanoa, the clear-skinned *pescados blancos* of the Chapala Lake, and the pop-eyes and grenadiers of three miles drop of Bering Sea. Till you learn how to know fish you cannot imagine what the water depths still have for you to know.

The second good reason why you should go a-fishing is that you may know the places where fishes go. All the finest scenery is full of fish. The Fire-hole Canyon, the Roaring River, the Agna Bonita, the Rio Blanco, de Orizaba, the creek of Captains Harbor, the Saranna, the Roanoke, the Restigouche, the Nipigon, and the lakes of

the St. John, and all these are good fishing water of their kind. So is the Rio Almendares, the Twin Lakes, and the Eagle River, the Sawtooth Mountains, the Venados Islands, the shores of Clipperton, the Pearl Islands, Dead Man's Reef, No Man's Land, and the sand reaches of San Diego, Santa Barbara, Pensacola, and Beaufort. If you know all these you know the rest of the United States, with Canada and Mexico as well. All this is a goodly country, which it is well for a good citizen to understand. If you go a-fishing to know the fish, the rest will be granted to you. And, with all the rest, you have filled your mind not only with pictures of plunging trout, of leaping muscallonge, and diving barracuda, but you have enriched it with endless vistas of deep, green pools; of foamy cascades, flower-carpeted meadows, or dark pines and sunny pines, white birch and clinging vines, and wallowing mangrove. You have "dominion over palm and pine," the only dominion there is, for your dominion doth not "speedily pass away." You know the crescent bay, with its white breakers, the rush of the eager waters through the tide-worn estuary, the clinging fucus on the rocks at low tide, the bark of the sea wolves, and the roar of the sea lions in the long lines of swaying kelp which reach far out into the farthest sea. This is good for you to know, for it is an antidote to selfishness and doubt and care. Then, too, it is good to know the men that live in the open where the fishes are. To shake their hands and share their hospitality will cure you of pessimism and distrust of democracy, and banish all the chimeras and goblins which vex those who live too long in cities. To hear the elk's whistle and the

ouzel's call, the whirr of the grouse's wings and the rush of the water in the canyon, will get out of your brain the shriek of cable cars, the rattle of the elevated railway, and all the unwholesome jangle of men who meet to make money.

So there is a third reason for going a-fishing—not so good as the first two, but still very noble. We may fish for rest or exercise, which is but another form of rest. We may fish placidly in the placid brooks, as Walton did, for chub and dace, till our thoughts flow as placidly as the Charles, or the Suwanee, or the Thames. Or we may fish in the rush and roar of the Des Chutes or the Buttermilk, tramping through the pines to Agua Bonita, or far across the desert to Trapper's Lake, or struggling through the wooded reaches to the Saranac. We may come back at night tired enough to lie flat on the floor and "drip off the edges" of it, but withal at peace with all the world—it matters not whether we have fish or not.

There is one reason for fishing which is wholly indifferent—that is to go a-fishing for the meat which is in the fish. This is pan-fishing or pot-fishing. If you get your living by it, that is your business. It is frequently an honest business. But it is not a matter of pride. If you caught a hundred trout in the Au Sable and ate them all you were fortunate. They helped out your store of provisions, and trout are very fair eating when properly fried. But don't brag about it. It interests the rest of us no more than if you boasted of catching ten frogs, or eating a hundred chickens in a hundred consecutive days. The matter of fish as food belongs to economics or some other dismal

science. By eating trout or bass you can never get "on the good side of the man who knows fish."

There remains one reason for going fishing which is positively horribly, disgustingly bad — that is, to see how many fish you can catch, just for numbers' sake. This is called "hog-fishing," and whether your purpose be to brag over the size of your basket or to lie about the catch, or both, it is bad — bad for the fish, bad for the rivers, bad for your neighbors, bad for you. The good man will never slay fish wantonly. We creatures of God on the earth together should enjoy each other, and the beautiful world, which is ours alike.

Because man is the wisest of all, with greatest power of knowledge and capacity for happiness, it is all the more incumbent on him to preserve the world as fair as he found it, and to respect the rights so far as may be of every other man and beast. DAVID STARR JORDAN.

SUNFISH

The common Sunfish is the first acquaintance of the amateur piscatorial artist. Every boy has had experience with "the pun'kin seed," even if it were only while dangling a bent pin upon the end of a string from the side of a bridge or some overhanging tree. Its range is almost as great as that of the black bass, but its weight seldom exceeds one-half pound. Summer resorters at our northern inland lakes have noted the exemption of the sunfish and its near cousin, the blue gill, from the ravages of certain parasitic worms which sometimes ruin the bass and certain other

MUSKALLUNGE.
Esox masquinongy immaculatus
Greatly reduced.

AMERICAN C. ALBERTYPE CO., CHI. & N. Y.

fishes for table purposes. These worms are to be found close under the skin and the sportsman is urged to look before he eats. H. B. Shinn.

MUSKELLUNGE

The Muskellunge ranks first of the fresh-water game fishes. The northern species occurs in waters tributary to the Great Lakes, while the southern species, the Chautauqua muskellunge, is found in waters tributary to the Ohio River. Its weight sometimes reaches 100 pounds or more, and its length, 7½ or 8 feet. It feeds upon smaller fish and is usually caught by trolling.

H. B. Shinn.

GARPIKE

The Long-nosed Garpike is a true sport. Its elongated body, pelvic fin set well back toward the middle of the body, the single dorsal fin placed near the tail, — all indicate great ease and rapidity of movement. The long jaws with their strong teeth make the possessor a terror to all comers. The scales of enamel and the armored head attempt to make up for the soft places which exist in the internal skeleton. By its ample protection it survives and multiplies; because of its ferocious habits it has become a serious plague. It is rapidly spreading into northern streams, where it exterminates smaller but more valuable fish. As an article of food this fish is valueless, but to the scientist it is an object of great interest. It forms a transition link between the simplest fishlike forms which have only a cartilaginous

skeleton and the true fishes with their skeletons of bone. The form of the tail, with the slight curvature of the backbone upward into it, is an indication of a primitive condition; in other words, it is an old-fashioned tail; the garpike is to-day one of the remnants of a very large fish population which once inhabited the globe. Fossil remains of similar fishes are found imbedded in rocks high up on mountains or buried deep beneath overlying strata of great thickness. H. B. SHINN.

THE CALICO BASS*

The Calico Bass is so called because of the mottled and variegated coloring of the body and fins. It is also called the Strawberry Bass, the Grass Bass, the Bitter Head, the Lamplighter, and the Barfish.

It is abundant in all the lakes and ponds of the region of the Great Lakes and the upper Mississippi River, where it shows a preference for quiet, cool and clear water and grass-covered bottoms.

The calico bass is closely related to the crappie of the Lower Mississippi Valley. It is, however, seldom seen where the crappie is abundant, as the latter prefers muddy sloughs and bayous, and is not found as far north as the former.

The body of the calico bass is elongated, is much compressed, and of a bright, silvery olive-green color. The sides and fins are mottled with a darker green or brownish-green, the blotches being gathered into irregular bunches. The vertical fins also have markings in the form of a net-

THE CALICO BASS.
(Pomoxys sparoides.)

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work surrounding paler spots. The mouth is large and oblique. The usual length of the adult is about twelve inches.

The calico bass obtains its food largely from the lower forms of animal life, such as crustaceans, worms, and insects.

It is said that "from the fact that it thrives well in slow-moving waters, it deserves the favorable consideration of owners of large mill ponds, where there is a steady flow of water, as it requires very little care, except the first planting of it in waters suitable to its nature. It is not averse to an occasional minnow, but is not regarded as peculiarly aggressive, though provided by nature with an armature that enables it to defend itself against all comers."

THE RAINBOW TROUT

The Rainbow Trout is a native of the mountain streams and lakes of the Pacific coast, ranging from the coast of Washington to San Diego, California. It was first made known to science in 1855 by Dr. Gibbons from specimens taken from Leander Creek, California. It is an extremely variable species, varying greatly in size, color, activity, etc. Those found near the sea spend much of their time in salt water, where living is easier, and as a result, they grow larger, lose their bright color, and much of their activity. They usually return to fresh water with the salmon to feast upon their eggs.

The food of the rainbow trout is made up largely of worms, crustacea, insect larvæ, and the like. In the fall

those in salmon streams feast on salmon eggs. During the spawning time of the salmon the trout in the ocean return to fresh water and accompany the salmon to their spawning beds. Many persons who catch them for table use do so with hooks baited with salmon eggs. Often salmon eggs are salted and dried and thus retained as bait for the entire year. No other bait seems so tempting to the rainbow trout. The sea-run individuals are not so brightly colored as those which always remain in fresh water. On their return to fresh water they seem to have lost none of their game qualities. As a table fish they are not inferior to any fish taken in fresh water.

The size of the rainbow trout depends upon its surroundings, the volume and temperature of the water, and the amount of food it can obtain. They vary from the mere fingerlings found in small mountain brooks to those from ten to fourteen pounds, as found in Klamath and other similar lakes. The rainbow trout will live in warmer and more sluggish water than the brook trout, and for this reason it is being planted in many streams in the east, which are unsuitable for the brook trout.

SETH E. MEEK.

THE YELLOW PERCH*

This is a fresh-water fish, and is generally distributed over Europe, northern Asia, and North America, and so well known as to have been, it is said, selected for the type of an entire family of spiny-rayed fishes, the percidas, which is represented in European fresh waters by several

YELLOW PERCH.

SPECIMEN LOANED BY HON. CARTER H. HARRISON.

YELLOWSTONE CUT-THROAT TROUT.
(Salmo mykiss lewisi).
½ Life-size.

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other fishes such as the pope and the pike-perch. It inhabits rivers as well as lakes, and thrives best in waters of a depth of not less than three feet; in large, deep lakes it frequently descends to depths of fifty fathoms and more. It occurs in Scandinavia as far north as the sixty-ninth parallel, but does not extend to Iceland or any of the islands of Europe. In the Alps it ascends to an altitude of 4,000 feet.

The perch is carnivorous and voracious. It wanders about in small shoals within a certain district, playing havoc among small fishes, and is therefore objectionable in waters where more valuable fry is cultivated. Perch of three pounds in weight are often caught; one of five would now be regarded as an extraordinary specimen, though in rare instances we read of individuals exceeding even that weight. An old fisherman, Mr. George Northrup, a man of rare intelligence, tells us that of thousands of perch caught by him he never took one that weighed above three pounds.

Perch are good, wholesome food, and highly esteemed in inland countries where marine fish can be obtained only with difficulty. The nearly allied pike-perch is one of the best European food fishes. It is very prolific, begins to spawn when three years old, in April or May, depositing the ova on water plants.

THE YELLOWSTONE CUT-THROAT TROUT

In their valuable work, "The Fishes of North and Middle America," Doctors Jordan and Evermann tell us that the Yellowstone Trout may be found in "the Snake River Basin above the Shoshone Falls, and crossing the

main divide of the Rocky Mountains at Two-ocean Pass to the head waters of the Yellowstone, thence to other affluents of the Upper Missouri." In many localities within its range this fish is quite abundant. It is a variety of a species which is a native of the clear and cold streams of Alaska and Kamchatka. In those regions it bears the vernacular name *Mykiss*. The variegated name *lewisi* was given the Yellowstone form in honor of Captain Meriwether Lewis, who in 1803-1806 was the leader of the memorable exploring expedition of Lewis and Clark, and who brought back specimens of this interesting and gamy fish.

The typical form of the species *mykiss* is represented by ten or more varieties, each of which is the type found in the waters of a circumscribed locality. The trout of our illustration is characterized by a red marking on the throat which has given the fish the name cut-throat trout. This red mark is also present on the throats of some of the other varieties of the species.

The Yellowstone trout is of interest for other reasons than those that would naturally be advanced by the angler. This fish is found on both sides of that stupendous watershed, the Rocky Mountains, on one side of which the streams flow toward the Pacific Ocean, and on the other toward the Mississippi River. The Snake River, of the west side, and the Yellowstone River, of the east side, are connected by two streams which cross the divide through Two-ocean Pass. It has been conclusively shown by Doctors Jordan and Evermann that the "Trout of the Yellowstone and the Upper Missouri is derived directly from that of the Upper Snake River." SETH MINDWELL.

BROOK TROUT*

This well-known and greatly prized game fish is found between the parallels of latitude 50 degrees north and 36 degrees south, though in Labrador, in latitude 54 degrees, and in the Appalachian Mountain ranges as far south as the northern border of Georgia and South Carolina, it has been taken in abundance. Northwestern Minnesota is its northern limit, and it is only occasionally caught west of the Mississippi River, except in a few of its tributaries. Specimens weighing seventeen pounds have been taken, the largest being found in the Nipigon River, in Ontario, and on the north shore of Lake Superior, where the seventeen-pound specimen referred to was caught. It is found in the large lakes and in the smallest ponds, the tiniest brooks and the largest rivers. The Nipigon River is forty-five miles in length and has a depth, in places, of from one hundred to two hundred feet.

Although a bold biter, the brook trout is wary, and usually requires all the skill of an experienced fisherman to capture it. The bait commonly used to entice it to bite is artificial or natural flies, minnows, crickets, grubs, grasshoppers, fish spawn, or the eyes or cut pieces of other trout. Its period of spawning is from September to the last of November, and it begins to reproduce its kind when about two years of age, when it measures some six inches in length. In the early summer the trout sports in rapids and swiftly running water, and in midsummer finds a retreat in deep, cool, and shaded pools. In August and September

the females gather about the mouths of gravelly brooks, whither they resort to make their spawning beds.

THE MONTANA GRAYLING*

The Graylings are among the most beautiful of the fishes. Bright in color and graceful in form, they have been called "the flowers of the finny tribes." There are about five species, and all are fascinating to look upon. Two of the species and one variety are natives of North America. The graylings frequent only the rivers of cold water in the northern temperate and Arctic regions. They are active and gamy, and some anglers claim that their game qualities are fully the equal of those of the brook trout. The food also is like that of the trout, and consists of insects that light or fall upon the surface of the stream.

The generic range of these fishes is quite extensive ; they are found in Lapland and England ; throughout Europe as far southward as Italy ; in Northern Asia, and in the rivers of Alaska and British America. In the United States, however, graylings are found in but two localities, certain streams of Michigan and the tributaries of the Missouri River. Those of the Missouri region are considered a variety of the Michigan species, and differ but little from that form in appearance.

The grayling, as a rule, does not leap out of the water when the angler is trying to "land" it, but rather flounders about in positions that are even more liable to tear the hook from its tender mouth than would the act of leaping. By the active use of its beautifully tinted and large dorsal-fin,

SPECIMEN LOANED BY HON. CARTER H. HARRISON

MONTANA GRAYLING.

(Thymallus ontariensis montanus)

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which is one of the most distinguishing characteristics of the grayling, it may escape at a point in the combat when the success of the angler seems assured.

The average size of the Montana grayling is from ten to twelve inches, and the weight from one-half to one pound. Individuals have been taken, however, that were about twenty inches in length, and weighing about two pounds. SETH MINDWELL.

THE BLACK BASS

To the true fisherman, the Black Bass of the north is a game fish worth his best efforts for its capture. There are two species, the large-mouth black bass and the small-mouth black bass.

Due to the fact that the basses have a wide geographical range, they have received numerous popular names. In the north, the large-mouth species is usually called black bass, while in Virginia and the neighboring states it is more frequently called the chub, and in the southern states it is known by the name trout. The name jumper is, perhaps, one of the most appropriate of its common names, and the name is quite as applicable to the small-mouth species.

The large-mouth bass is also known by a number of other names which have less significance. Some of these are Oswego bass, lake bass, bayou bass, green bass, yellow bass, moss bass, and, in a few localities of the south, it is called Welchman. The small-mouth black bass is also favored with a large number of names, many of which are purely local and need not be mentioned. A few of the more com-

mon ones are : Lake bass, ninny bass, hog bass, brown bass or trout, black or trout perch, and mountain trout.

The range of the large-mouth black bass may be considered as covering the larger part of the eastern United States and southern British America, westward to the Dakotas, Nebraska, and Kansas. That of the small-mouth bass, though large, is less extensive, covering a territory "from Lake Champlain to Manitoba, and southward on both sides of the Alleghanies to South Carolina and Arkansas." These are the natural ranges of the two species. They are able, however, to adapt themselves to great extremes of temperature and to adverse conditions. For these reasons, their ranges of distribution have been greatly extended by introduction by human methods into nearly every portion of the United States where they were formerly not a part of the fish fauna. SETH MINDWELL.

LARGE-MOUTHED BLACK BASS.

(*Micropterus salmoides*)

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CHAPTER IV

THE REPTILE TRIBE

REPTILES, or creeping animals, as a class, are marked by the scaly covering of the body, and by the omission of any tadpole stage after hatching, and by certain internal structures.

They are spread over those portions of the globe where the climate is tolerably warm, but are found in the greatest numbers in the hotter portions of the globe,

They are generally semi-aquatic, being fitted for travel both upon land and in water.

"Dull sluggishness seems to be the general character of a reptile. Their ordinary movements are inert, their gestures express no feeling, and their eyes, though bright, are stony, cold and passionless."

Reptiles usually lay their eggs in the sand, where they are hatched by the heat of the sun.

THE COLLARED LIZARD*

The Collared or Ring-necked Lizard may be found among the rocks and open woods of the plateau or in desert regions from southern Missouri southward into Mexico, westward to southeastern California, and northward to southern Idaho. However, this is its general range, and it is not common over all this territory. Though it has been

known to ascend to an altitude of nearly 6,000 feet, yet it does not seem to have crossed the Sierra Nevada range, as it has not been observed at any point on the Pacific coast or the interior of California.

The collared lizard is so called because of the black bars, which resemble a collar, and are situated between the forelegs and extend across the back of the animal. They vary greatly in color, depending on their age or geographical position. The back is usually some shade of dull or rather dark green, or it may have a bluish cast with numerous oblong or rounded lighter spots, which may be either whitish, or various shades of red, orange or yellow. These spots may be quite definite or they may form quite continuous bands. The variations in color are much more marked in the young.

Dr. Cope tells us that "it runs very swiftly, carrying the tail over its back. In its manners it is perhaps the most pugnacious of our lizards, opening its mouth when cornered, and biting savagely. Its sharp teeth can do no more than slightly cut the skin."

Mr. Frank M. Woodruff relates the following interesting account of his experiences with this lizard: "I found the collared lizard at three points in Missouri — Vineland, DeSoto, and Pilot Knob. They are restricted to the rocky slades, where they live with the scorpions and the rattlesnakes. The only place where I found them abundant was between Vineland and the old Kingston mines. During the hot summer months they make their appearance upon the broad slabs of rock, often quite a distance from their lairs. When disturbed they make a dash to escape and, usually,

COLLARED LIZARD.
(Crotaphytus collaris.)
About ¼ Life-size.

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HORNED TOADS (LIZARDS).
Life-size

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in the direction that leads to their accustomed crevice, even though the intruder is in its path."

HORNED TOADS*

The Horned Toads form an interesting group of lizards which are related to the iguanas of the tropical forests of America. They are, however, terrestrial lizards, inhabiting the plains of southwestern United States and Mexico. Their short, broad and more or less flattened bodies, rounded heads and short tails give these animals quite a striking resemblance to the common toad. Hence their common name. In one respect, however, they are not at all like the toad. The head is armed behind with a row of quite formidable horny spines, and in some of the species shorter ones are also present on the top of the head and on various parts of the body. As these lizards are slow in motion, the horns constitute one of their chief means of defense. When in the presence of an enemy "the muzzle is depressed and the horns are elevated. The back is also arched." The utility of the horns as a means of defense has been amply proven. The dead bodies of snakes have been found with the horns protruding through the skin of the body near the head. But this is not their only means of defense. From birds they are protected by their coloration, which is a somber mixture of brown, black and yellowish, and when quietly resting on sands or rocks in the open they quite closely resemble stones covered with lichens of varying shades of color. Abundant as they are in some arid regions of the southwest, they frequently escape the notice

of the observer because of their coloration. In such regions, too, they can take refuge beneath the protecting spines of the Agaves and the branches of the prickly Opuntias.

One of the most remarkable habits of at least one of the species, and possibly of all the horned toads, is the power of ejecting jets of blood from the eyes. This power is rarely exercised, and, seemingly, only when greatly irritated.

THE GILA MONSTER

The reptile fauna of the North American continent includes a curious lizard known as Gila Monster, in science called *Heloderma*. It represents a family all to itself, with only two species: *Heloderma horridum* and *Heloderma suspectum*.

Francisco Hernandez, a Spanish physician and naturalist, was the first to know of its existence, when he found it in Mexico in the year 1651. In an account of his explorations he mentions a lizard three feet long, with a thick-set body, covered with wart-like skin, gaudily colored in orange and black, and generally of such horrid appearance that Wiegman, another scientist, two hundred years later, called it *Heloderma horridum*.

For a long time this name was given indiscriminately to all lizards of this kind, living either south or north of the boundary line of Mexico and the United States, till Professor Cope discovered a difference between them and called the variety found in our southwestern territories and states *Heloderma suspectum*.

Many other naturalists have since taken up the study of

GILA MONSTER.
(Heloderma suspectum.)
About ¼ Life size.

this interesting reptile. The result of their observations and experiments was that they all agree in acknowledging the *heloderma* as the only poisonous lizard in existence, although their opinions are at variance as to the effect of its venom on the human system. Dr. van Denburgh in his latest researches has found two glands, one on each side of the lower jaw, located between the skin and the bone. Such a venom-producing gland being taken out of its enveloping membrane proves to be not a single body, but an agglomeration of several small ones, differing in size, and each emptying through a separate duct. These glands are not directly communicated to the teeth. When the animal is highly irritated, caused by constant teasing or rough handling or by being trodden upon, the poison is emitted by the glands, gathers on the floor of the mouth, where it mixes with the saliva, and is transmitted through the bite.

A *heloderma* has no fangs, but a goodly number of sharp, pointed teeth, both on the upper and lower jaws.

The venom of the Gila Monster injected into the veins and arteries of smaller animals as rats, cavies, and rabbits, and into the breast of pigeons and chickens, causes death within twenty seconds to seven minutes.

AMELIA WALSON.

THE SNAPPING-TURTLE*

By reason of the ferocity of disposition of this curious animal, the Snapping-turtle (*Crelydra serpentina*) is rather formidable, not only to the smaller creatures which inhabit the same localities, but also to man, its bite causing very

severe wounds. It is found in America, from Canada to Ecuador. It is bold as well as fierce, often suffering itself to be lifted from the ground by the object which it has grasped rather than to let go its hold.

These turtles are remarkably strong. The elder Agassiz states that he observed one bite off a piece of plank more than an inch thick. It is carnivorous in its habits, and is very destructive of fish, small quadrupeds, birds, and reptiles.

The flesh of the snapping-turtle is delicate, tender, and of rich flavor. Every fisherman knows that it will take almost any kind of bait, provided it be of animal substance. It, however, prefers fish, and cannot resist a hook so baited.

In the northern United States, from the 10th to the 20th of June, the female, at early morning, leaves the water and crawls to a sandbank, digs a small cavity with its hind leg, into which the small, round eggs are deposited to the number of twenty-five or thirty, when the sand is drawn over them, the surface smoothed down, and the animal is soon back in the water, the entire operation not lasting over twenty minutes. This method is different from that of our other land turtles. Nothing but sand will suit the purpose of the snapping-turtle. The sand must be quite dry and exposed to the full rays of the sun. The little ones are hatched in July. The young run by instinct into the water.

Remarkable stories are told of the longevity of the turtle and its tenacity of life. That they live to near a century is well authenticated. After the head is severed from the body the head will open and shut the mouth and roll the eyes. In one case a stick was held between the

SNAPPING TURTLE.
¼ Life-size.

open jaws, which closed upon it with violence, and kept hold of it. Meanwhile the headless body was crawling on the ground.

THE GEOGRAPHIC TURTLE*

Map and Mud-turtle (*Malacoclemmys geographicus*) are the more common names by which this animal is known; and as it is a characteristic species of the waters of Illinois and occurs in countless numbers in lakes, rivers, and flood-ground pools, it may be assumed that most of our readers have met with it. It is exceedingly common in the Illinois and Mississippi Rivers, where it is often confounded with quite another species. It is the only species seen by Mr. F. M. Woodruff on the shores of Lake Michigan, whence he has frequently chased it to the water and caught it in his hands. It is timid and inoffensive in disposition, always sliding from bank to log when approached, and even when captured shows none of the ferocity of the snapper. The great strength of its jaws, unsurpassed in massiveness by any of our turtles, would enable it to inflict serious wounds, and it is not a little surprising to find such efficient weapons of offense unaccompanied by special ruggedness of temper. Our streams and lakes, with their numerous sandy shores, and their abundance of animal and vegetable life, would seem to form an ideal habitat for these reptiles. Their food consists ordinarily of fishes, frogs, and mollusks, crayfishes, aquatic insects, and vegetation. They trouble fishermen at times by devouring fishes which they have caught on trot-lines or in set nets. They are not rapid

swimmers. An animal once within reach of their jaws must be very quick to escape capture. The eggs are white and are provided with a rather tough shell. They bury their eggs in sand on the shore, and leave them to hatch by the sun's heat.

GEOGRAPHIC TURTLE.

CHAPTER V

A NOTED HOOFED GROUP

The hoofed animals, called *Ungulata,* are those whose toe nails are strongly developed for protection and support. They are of many widely differing forms and they occur in just as widely differing localities. There is the small pig-like creature, the peccary of sub-tropical America, the camel of the desert, the bighorn of the mountains, and the reindeer of the frozen north. In size ungulates vary from the tiny hydrax and the domestic pig to the elephant. No other group, perhaps, illustrates so well as does that of the hoofed animals diversity of structure which may result from peculiar habits of life. There are many divisions and sub-divisions in the group, perhaps the most important one being the classification of even-toed and odd-toed forms, the pig, the cow, and the sheep being even-toed, and the horse, odd-toed. The presence of antlers or horns is a striking characteristic of many of the group, as is also the fact that they are all almost strictly herbivorous.

The horns or antlers are of two distinct types. Those of one are hollow ; they are constantly growing at the base and are never cast off. Such horns are usually marked by rings or lines of growth like those of a clam shell or of a tree. The other form of horn is solid and is cast off each year, being replaced very quickly by another and larger one. This form is usually marked by being forked or

pronged, and the age of the animal is accurately told by the number of prongs or "points" present in the antler. These horns are spongy at first and while growing are penetrated with a very elaborate system of blood vessels, are richly nourished, and are covered with a delicate skin or "velvet." Within a few weeks after shedding of the old antlers, the tissues of the new ones harden; constrictions occur at their bases, which cut off the blood supply and the vitality of the horn, so that the velvet then comes away from the surfaces. This annual shedding of the antlers is an expensive process, and it greatly affects the animal's physical condition and disposition at the time.

H. B. Shinn.

ALASKAN MOOSE

The Alaskan Moose is the largest member of the deer family. The American moose ranges from New York and Maine northward and westward through Canada and across the Montana line into Minnesota, Dakota, and Montana. In spite of the enormous antlers, the moose is a creature of the woods ; it browses in the thickets surrounding woodland lakes and wades out into the shallow water to feed upon lilies and similar edible plants ; for such habits the long legs are well adapted. These animals are nearly always hunted during the rutting or mating season; the hunter imitates the call of the cow moose by the use of a birch-bark trumpet. In winter the animals travel in groups of three to six; the company is a polygamous family composed of the old bull and two or three cows with their young and possibly their

yearling calves. They may go from place to place feeding upon young twigs or such herbage as they can expose by scraping away the snow, or they may remain in a sheltered wood or thicket, called by the hunters the "moose yard." The antlers of the moose are palmate, or shaped somewhat like the palm of one's hand; the nose, or muzzle, is soft and flexible; in fact, is almost prehensile; the feet are cloven like those of a cow. These animals are much sought after by hunters, but they deserve preservation similar to that now afforded the American bison and the deer. The protection of the deer in Maine has resulted in their becoming far more numerous than they were when the white man first entered the country. This means that many hunters are afforded profitable recreation who, without the existence of game laws and the legal protection of wild game, would be compelled to forego the pleasures of hunting under almost primitive conditions. The moose will probably get protection at the eleventh hour. H. B. Shinn.

THE AMERICAN ELK, OR WAPITI

The American Elk was first so called because of its general resemblance to the European elk, which is in reality a close relative of the moose; it is not, however, an elk, for, as the illustration shows, the antlers are not palmate. It would then be more correct to insist upon naming this form the wapiti. On account of its size it has been called "The King of the Deer"; it is a member of the deer family, the antlers being present only upon the male, and being shed annually. It formerly ranged throughout northern United

States and Canada and southward in mountainous districts, but it is now extinct except in remote regions of the west.

Its average height at the shoulder is about five feet, and the antlers themselves are usually about five feet broad. It is at home on the plains, where it browses in the open country, or in the woodland, where it feeds upon young twigs and herbage; it is one of the easiest of the deer to keep in captivity.

After the pairing season, the wapiti assemble in constantly enlarging herds, finding it to their mutual protection to travel and browse in large companies. While such a herd is browsing, the patriarch usually ascends some knoll and acts as lookout, with his shrill whistle warning the others of approaching danger. This habit indicates a fair development of the social instinct, for there must be present the faculty for leadership in the male and conscious willingness of the other animals to be led and guided. The antlers are usually dropped in the spring, and within three months the new ones have attained full size once more. The fawn is usually born in April, when food is abundant. Many stories are to be related regarding the habits of the wapiti and the fierce struggles between the males for leadership. Such rivalry is very widespread among animals, for almost all show it. Where it does exist, the males usually have attained greater size and strength than the females, for their struggles to gain and retain the leadership of even a small herd are severe and only the largest ones can be successful. This great size has also resulted in the habit of one male retaining as mates more than one female. Such a relation-

413

AMERICAN ELK. WAPITI.
(Cervus canadensis.)

FROM COL. CHI. ACAD. SCIENCES

PRONG-HORNED ANTELOPE.
(Antilocapra americana.)
Greatly reduced.

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A. G. M. MUSEUM (INC.) A.

ship is called polygamy. Among animals which practice monogamy, the male and female are scarcely different in size. H. B. SHINN.

THE PRONG-HORNED ANTELOPE*

Prong-horned Antelope is not as large nor so strikingly horned as some other members of the antelope family. In fact, so different is its structure, having hollow, pronged horns which do not increase by continuous growth, as do those of the true antelopes, but are shed like those of the deer family, and having a somewhat different structure of feet and different texture of hair, that a family has been made for it, known as *Antilocapridæ*.

The prong-horn ranges throughout the western part of North America from the Missouri River to the Pacific Ocean, and from Saskatchewan River south to the Rio Grande. It is not confined to the plains, but has been found in the wild valleys of the Rocky Mountains to a height of over eight thousand feet above sea level.

The daily life of this interesting animal is thus described by Canfield, who made an exhaustive study of them, and who also kept them in captivity: "From the first of September to the first of March one always sees them in larger groups, composed of bucks, does, and yearlings. Shortly afterward the does individually retire from these herds and give birth to their young. After a short interval they again unite with other suckling does and their little calves, possibly with a view to common defense against the wolves and coyotes. The adult bucks roam about singly or two

together, leaving the mothers with their latest progeny to their fate, the young prong-horns in the meantime gathering in groups of their own, apart from the older animals. Apparently tired of the world and bored by society, the old bucks wander about for one or two months, frequenting localities in which they are not ordinarily seen. Two or three months subsequently the adolescent bucks again join the old does and their calves, and finally the old bucks also put in an appearance, so that one can observe herds numbering hundreds, or sometimes even thousands, after the first of September."

THE PIGMY ANTELOPE*

The Pigmy Antelopes present examples of singular members of the family, in that they are of exceedingly diminutive size, the smallest being no larger than a large rat, dainty creatures indeed. The pigmy is an inhabitant of South Africa, and its habits are said to be quite similar to those of its brother of the western portion of North America.

The antelope is a very wary animal, but the sentiment of curiosity is implanted so strongly in its nature that it often leads it to reconnoitre too closely some object which it cannot clearly make out, and its investigations are pursued until "the dire answer to all inquiries is given by the sharp 'spang!' of the rifle and the answering 'spat!' as the ball strikes the beautiful creature's flank."

The pigmy antelope is not hunted, however, as is its larger congener, and may be considered rather as a diminu-

PYGMY ANTELOPE

tive curiosity of Nature's delicate workmanship than as the legitimate prey of man.

THE DOMESTIC HORSE

A great many thousand years ago there lived in the western part of North America, in what is now Wyoming, a small animal, hardly as large as a fox. It had a long face, with many teeth for eating vegetation, bushy tail, short hair on its body, and hair down the back of its neck. This primitive horse had five toes on each foot. Through succeeding centuries the animal gradually increased in size, in length of limb, and in speed; the teeth became fewer in number but better developed for grinding; and the toes gradually decreased to four, to three, and finally to one. When the animal had attained the size of the modern pony it disappeared from North America, doubtless because of conditions of climate or food supply, but it had made its way across reaches of land which connected Asia and America; it persisted in southern Asia. In consequence, the modern horse reached its highest development in Europe, Asia, and Africa, and came to live in America only when it was brought over by the early discoverers and colonists in modern times. Conditions here were again so favorable, however, that it soon adapted itself to a wild life on the plains; there it has come to be called Indian Pony and Mustang. Asiatic forms long ago became specialized or branched off to form the African zebra, the ass, the Shetland pony, the wild pony of Thibet, and the Arabian horse. By intelligent, careful breeding, man has developed within

the last thousand years those varieties with which we are all more or less familiar. Besides the ponies, there are the heavy draft horses, such as the Percheron and the Shire, the lighter but enduring coach or carriage types, and the lightest but the most speedy of all, the thoroughbreds and trotters.

The form illustrated is a Thoroughbred, a form which was developed in the United States and Great Britain about two hundred years ago. It is distinguished by the fine head and muzzle, the prominent and delicate ears, the rather small chest, the long and rather full hind quarters; the legs themselves are rather slender and clean in outline. Such a horse as this would probably weigh about one thousand pounds. The highest price recorded for a horse of this type is $187,500, which was paid for the stallion Flying Fox, in England, in 1904. The highest amount of winnings recorded by Mr. Plumb is $249,502, and the fastest recorded time is 1:35½ for a straightaway mile.

H. B. Shinn.

THE ZEBRA

The Zebra is of all things a freedom-loving animal. He will go like the wind and, if pursued singly, cannot be caught. It is true that large herds are overtaken, as they impede each other's progress, but it is a shame that these beautiful creatures should be hunted at all. The European will try to kill them with bullets, the natives with javelins, but more frequently these dainty animals are caught in pitfalls and then captured or slain, according to the will of the pursuer.

THE DOMESTIC HORSE.
(Equus caballus.)

ZEBRA.

They live gregariously and are found in groups of from ten to twenty, though there are accounts of large herds. Probably these were migrating. When running, they usually go in single file, the stallions leading. They are not very fastidious in regard to their food, but if the supply fails in one place they seek another locality. The zebra defends itself from other animals by biting and kicking, and the lion is about the only foe which can overcome it.

Of the three species, the mountain zebra or true zebra lives farthest south. It ranges over the mountainous country of Cape Colony. It is the smallest of the three varieties, and is distinguished from the others not only by the peculiar markings but by the large ears, short mane, and scantily haired tail. It is the only variety where the transverse markings of the legs extend to the hoofs.

It is a very curious fact that the different species of zebra are never found together.

The Burchell's zebra is the largest and noblest appearing of the species. It is a rover of the plains and does not seek the mountainous districts where the true zebra is found. It stands about four and one-half feet in height at the shoulders. It is not found south of the Orange River and it is not known how far north its range extends.

Our illustration shows an example of Chapman's zebra. This, in reality, is a variety of Burchell's zebra, and should not be considered apart from it.

The third species is called Grévy's zebra. More slender than the true zebra, it is somewhat like it in its markings.

JOHN AINSLEE.

THE COW

The Cow was developed in prehistoric times, from the wild cattle of Europe and Asia. As in the case of the horse, there have arisen many distinct varieties, though only two distinct types, namely, the beef and the dairy. The former is a large, square built, heavy form; the latter, a more angular, less beefy, and better producer of milk.

The outline of the cow along the back is almost straight from the crown of the head to the base of the tail. In the beef type the lower line of the body is more or less parallel with this line, but in the dairy type is so slanting that if both lines were continued forward they would meet not far from the head, thus forming a V. When seen from above, the cow is widest at the hips and pointed at the head, forming a second V. When seen from behind, the body is broad above but narrow toward the feet, thus forming a third V. As a general rule, the dairy cow closest approaching perfection in these three V's ranks the highest in excellence of outline; the beef type is more rectangular in outline. The expression of the face is a very good index of the disposition and milk production, for a wild, nervous creature will spend her energies in roaming or fence jumping, while a creature of mild and contented character will afford more time for browsing and the production of milk. The quantity of milk produced, while of great importance, is minor to the milk quality. There is no way of determining the work of a cow by mere guess or conjecture. The total yield of butter fat for a period of time and the total cost of feed

James M. Ward.

should be carefully accounted against each cow of the herd. Liberty is taken here of quoting a school bulletin of the Agricultural College of the University of Illinois:

"At the Agricultural Experiment Station are two cows, the story of whose work is well worth telling. They were brought up alike on a farm near Elgin, Illinois, and obtained their early education in the same herd of one hundred cows. Here at the University, with the same surroundings and equal opportunities, they have drifted far apart in character, and their progress has been in opposite directions. It is not a difference of hide, or horns, or temper; it is not that one is wild and the other a pet. It is not a difference of beauty or intelligence, but solely a difference in the way they have worked—a difference in the money they have earned for the owner.

"All the milk of these cows has been weighed and tested for three years. A record has been kept of every pound of feed consumed by each animal, both summer and winter.

"Each year Gold produced on the average 11,390 pounds of milk, containing 405 pounds of butter fat; but during the same time Gilt averaged only 3,830 pounds of milk, with 138 pounds of butter fat.

"These cows were both cared for in the same way; they were given the same kinds of feed and allowed to eat all they wanted. Gold ate one-half more than Gilt, but produced nearly three times as much milk.

"Equal amounts of feed made in the one case 199 pounds of butter fat, and in the other 100 pounds. The one cow produced nearly twice as much as the other from exactly the same feed in kind and amount.

"Counting the butter fat at 23 cents per pound, and taking out the exact cost of feed in each case, the one cow brought in a profit of $34.59, while the other lacked $5.62 of paying for her board at market prices of feed each year.

"This comparison, exact and complete for three years, and including the record of both milk and feed, means a great deal more than a single year's comparison."

H. B. Shinn.

THE AMERICAN BISON, OR "BUFFALO"

To the world at large, the Bison is probably the most famous of American animals. Its large size and massive appearance, its enormous numbers, and its value as a source of food and clothing have contributed to its fame and also to its extermination, for no hunter is ever content to hunt small game if large is to be found. The bison should be distinguished from the buffalo, which is found in Africa and Asia, in that it possesses a marked hump on its shoulders. In habits it is similar to the domestic cow, for its tooth structure, its feeding habits, such as browsing and cud-chewing, and its general anatomy are closely similar to that of the domestic animal. At the present time there are perhaps fifteen hundred buffaloes in captivity in various public or private collections; but as recently as 1880 they existed by the hundreds of thousands in the Western plains and mountain valleys. The following extract from Hornaday's "American Natural History" will give an idea of the enormous numbers which at one time existed in the United States:

AMERICAN BISON OR BUFFALO.
(Bison americanus).

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"It is safe to say that no man ever saw in one day a greater panorama of animal life than that related by Col. R. I. Dodge, in May, 1871, when he drove for twenty-five miles along the Arkansas River, through the unbroken herd of buffaloes. By my calculation, he actually saw on that memorable day nearly half a million head. It was the great Southern herd, on its annual spring migration northward, and it must have contained one and one-half millions. In those days mighty hosts of buffaloes frequently stopped or derailed railway trains and obstructed the progress of boats on the Missouri and Yellowstone rivers."

The average height of these animals at the shoulder is somewhat less than six feet; the females are usually much smaller than the males, for the animals are polygamous. At the breeding season they formerly gathered in enormous herds and all was excitement, owing to the conflicts of the various bulls. During the winter they migrated southward and in summer northward.

The mating season was in the fall, when the bisons occupied their Southern feeding ground; the pairs remained in the company until spring, when the cows went off by themselves to the most sheltered spots they could find and gave birth to their calves. The latter grew rapidly and were soon able to follow their herd, though still jealously cared for and defended from all dangers by their mothers. The old bulls, in the meanwhile, had congregated in herds by themselves.

In order to escape the attacks of flies and other insects, they sought out muddy sloughs and shallow ponds where they could roll and wallow to their hearts' content and

emerge with their coats filled and plastered over with clay; this soon baked in the sun and formed a hideous but most effective armor, which would last for days.

Doubtless this account will reach persons who have had personal experience with the buffalo of the past, who know something of the value of its flesh for food and of its hide for storm-coats and lap-robes, of its horns for powder horns, and even of its chips for fuel. It is said that the flesh of the buffalo cannot be distinguished in flavor from that of the domestic cow, though it is somewhat tough.

H. B. Shinn.

THE MOUNTAIN SHEEP

The Mountain Sheep, or Bighorn, inhabits high mountain fastnesses from British Columbia to Arizona, but similar varieties are found outside of these limits. The average height of the animal at the shoulder is about three feet, its length about four feet, and its horns are about four feet around the curve. The form illustrated here is a male, for the horns of the female are small, short, and erect. During the summer season the sheep seek the open pasture near the timber line of high mountains, feeding upon the herbage of all kinds which grows luxuriantly during the short summer. In winter they retreat to the sheltered valleys of lower altitudes, where they feed by pawing the snow from the frozen grass. In their breeding habits these animals are very similar to the domestic sheep. Little needs to be said regarding the mountain sheep except that the difficult and danger attending the hunting of it are such as to appeal to all

MOUNTAIN SHEEP.

DOMESTIC SHEEP.
(Ovis aries.)

sportsmen. The result has been their almost complete extermination, and recently their complete protection by law for a term of years has been deemed necessary to enable them to repopulate their haunts. Keen of scent, of large size, living in most inaccessible places, they are very hard to stalk. The flesh itself is highly prized, and the possession of a pair of horns is very tangible proof of a hunter's skill. The color of these sheep, dingy yellow, renders them inconspicuous; the white rump-patch serves a purpose similar to that of the antelope, the wapiti, and the deer.

H. B. Shinn.

THE DOMESTIC SHEEP

The Sheep are domesticated forms of the wild sheep which in prehistoric times roamed throughout mountainous and hilly country the world over. Because of their docility and the excellence of their flesh and the great usefulness of their wool, they were soon domesticated, and almost the earliest industry of man of which we have any record is that of sheep raising. From many of the shepherd people there have come to us many great poems and the beginnings of such sciences as astronomy and mathematics.

As in the case of the cow, we have two very distinct types of sheep—the mutton and the wool. In the first, breeding has brought about a heavy, more or less square-built form which matures quickly; examples of it are the Southdown and other "Downs," and the Shropshire. The wool type is more apt to be of long neck and leg and of greater angularity throughout, much after the fashion of

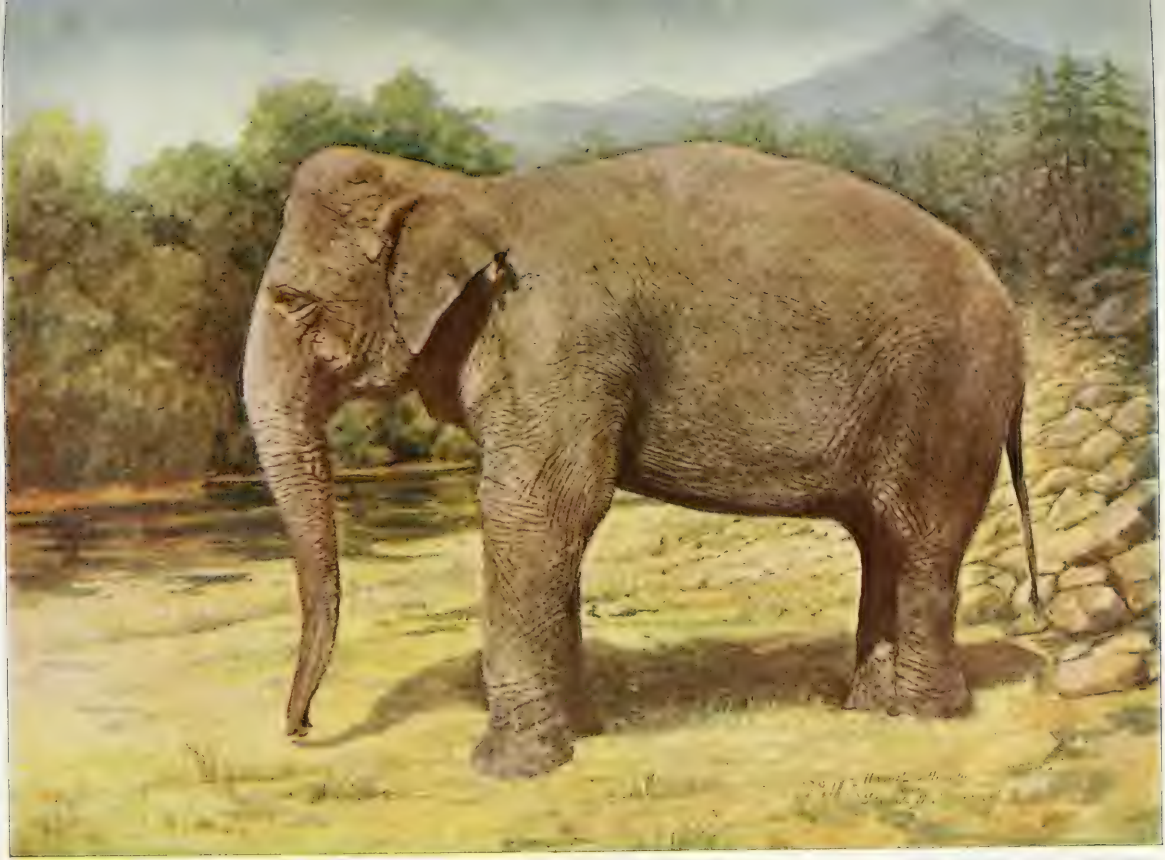
the dairy cow, while a greater surface of skin and a greater amount of wool is indicated by the heavy foldings of the skin, particularly about the neck; examples of this type are the Merino and the Rambouillet. As in the case of the cow, bulletins covering various phases of sheep industries may be obtained from the United States Department of Agriculture and from the various State agricultural stations.

Certain points in connection with the study of sheep are worthy of mention. In the wool type the more folds there are in the skin and the more crimping in the wool, the finer will be the fiber, or "staple." The wool should be at least one-fifth of the total live weight of the sheep; those sheep weighing about one hundred pounds should yield a fleece of about twenty pounds. The mutton type is heavy and square built, the neck rather short and level with the body, the legs slender and clean from the body down.

H. B. Shinn.

THE ELEPHANT

The Elephant originated in Africa, many ages ago, but being a great traveler, wandered throughout the world, passing from continent to continent across bridges which, in many cases, have since disappeared. The primitive forms have been found almost everywhere, two of the best known being the hairy mammoth and the mastodon. Inhabiting the tropics as it does, the typical covering of hair has become reduced to the smallest possible fraction and exists merely in the form of a few scattered bristles. To prevent the evaporation of moisture from the surface, the skin has



INDIAN OR ASIATIC ELEPHANT.
(Elephas maximus)

become leathery and tough, and because of this, the animal is called a pachyderm. Apparently, in its efforts to hold its own in nature, it found its size and strength very important factors; hence it became one of Nature's giants, averaging a total length over all of twenty-one feet, a height of nine feet, and sometimes a weight of eight thousand pounds. So large an animal could not sustain a heavy head at the end of a long neck, hence the neck remains short. The problem of securing food was solved by the elongation of the upper lip to form the trunk, or *proboscis*. Such an animal would only find sufficient food in a locality where the sunlight, reaching the ground, would stimulate a luxuriant growth of herbage. Thus the elephant is at home in a country quite open and well watered, not a desert, not a mountain top, not a region of long winters. Though not one of Nature's works of art, the elephant is one of her works of skill, and although it is said that the elephant lives to an age of four hundred years, during that time giving birth to only six offspring, yet it has maintained itself against all odds, and except for its coming destruction by man, it would doubtless continue to do so for a very long time to come. Stories of the usefulness of these animals are so common that none need be mentioned here. While the elephant is highly esteemed for its flesh, man has found its greatest usefulness as a beast of burden; he uses it in harness or under a peculiar form of saddle. The writer recalls having seen, in New York City, the members of a small troupe of elephants, on a very hot day of summer, eagerly receive into their mouths the end of a rubber hose; they held it there until their mouths and throats were full of

water; then, directing their trunks over their backs, they sprayed themselves very effectually. The performance was complete when they scattered over their backs dirt and straw picked up from the ground.

The Asiatic elephant differs from the African form in the smaller size of its ears and tusks and its lighter color. Both are hoofed mammals, or ungulates, having five connected toes. These, however, are so shortened that the animals seem to walk on the ends of their legs, which thus have the appearance of pillars. The most remarkable feature of the elephant's anatomy is the trunk; it serves both as an upper lip and as nostrils. In this way the odors of foods can be detected very delicately and material can be chosen either from the ground or from bushes and trees.

H. B. Shinn.

THE ASIATIC CAMEL

The Camel varies nearly as much as do the horses of our own country. There are many grades and degrees, from the ordinary baggage camel to the high-toned thoroughbred which corresponds to our high-class race horse. These racing camels are long-legged and long-necked; the hump stands upright, is conical in shape, and covers about one-fourth of the length of the body; the head is rather short, the eyes are large and dull, and the ears very small but mobile. The hair is especially fine and soft.

A friend of ours who owned a fine saddle camel was able to make from eighty to ninety miles a day if his camel was well fed and watered and was allowed a rest at noon.

ASIATIC OR BACTRIAN CAMEL.
(Camelus bactrianus).

This pace he was able to continue without injury for three or four consecutive days, and after a well-earned rest he could repeat the journey.

A baggage camel, carrying a load of perhaps three hundred pounds, would not make over thirty miles a day, but often could march twelve hours or longer without rest.

The food supply which assists the camel in times of fasting is stored in the hump, which is really one great lump of fat. In times of plenty this is firm and pyramid-like in form, and may weigh as much as thirty pounds; but after prolonged hunger it will nearly disappear, weighing, perhaps, only four to six pounds.

A baby camel is a misshapen little thing, but, like all young animals, it is playful and interesting. It is about three feet high when it enters the world, but in a week's time is much larger. It is able to follow its mother soon after birth. She will defend her own to the extent of her strength if needful.

The camel is a true animal of the desert, and thrives only in a hot, dry locality. It is of little use in a mountainous country, as it is a poor climber, and cannot remain in health when fed on luxuriant vegetation.

In the water it is of still less use; perhaps because the desert is its "native heath." JOHN AINSLIE.

THE GIRAFFE

Should a traveler returning from a far country describe a wonderful animal, with the head and body of a horse, neck and shoulders of a camel, ears of an ox, the tail of an ass,

the legs of an antelope, and the coloring and marking of a panther, he would be believed with difficulty; and yet this combination very fairly describes the curious and interesting animal kn wn to us as the Giraffe.

This name is a corruption of the Arabian *serafe,* "the lovely one." The giraffe is found in a wide curve, extending over the eastern half of Africa from Ethiopia as far south as the confines of Cape Colony. Within this area it frequents the sandy, desert-like portions where small trees and shrubs abound.

The head of a giraffe is really a thing of beauty. On account of the delicate contour of the muzzle, the head appears longer than it really is. The nostrils can be opened and closed at will, making it possible to avoid injury from the sand storms which sometimes prevail. The eyes are the largest, for the size of the head, of any animal, and are wonderfully gentle, lustrous, and beautiful. They are also capable of some lateral projection, so that to a degree the animal can see behind it without turning its head.

Notwithstanding the extreme length of the neck of the giraffe, it contains but seven bones, the same number as man.

Its sloping back has led some people to suppose that the legs were uneven in length; this is an error, as the legs are about the same length, and the feet have delicate, beautifully shaped, divided hoofs.

The tail of the animal is long and finished with a generous tuft of hair with which it relieves itself of the seroot flies and other stinging insects which otherwise would become unbearable.

Like the American bison, the giraffe is in danger of extermination. It originally had a larger range, but has been killed in great numbers. The temptation to hunt the animal is not to be resisted, as the hide of the bull brings from twenty to twenty-five dollars, the flesh is very fine eating, and the other parts of the body can be put to various uses. JOHN AINSLIE.

THE PECCARY

Scientifically, this animal is classified with the domestic pig, the wild boar of Europe, and the wart hog of Africa. Hunters hardly class it as big game, yet as an animal highly worthy of respect. The form here illustrated is the collared peccary of Mexico; a very similar variety ranges northward into Texas and Arkansas, where it is called the Texas peccary. These animals feed upon acorns and nuts, upon edible roots and tubers, and sometimes upon the bark of young trees. They are at home either in the tall grass and the marsh, in the open valley, or in the undergrowth of the forest. They frequently travel in large numbers for protection, for they defend to the death, with tusks and hoofs, an injured member of their pack. It is said the smell of blood enrages them to such an extent that a man is hardly safe when they pursue him. Their canine teeth, very prominent in both jaws, render them formidable opponents. A musk gland secretes an odor very grateful to peccaries, but highly offensive to man. However, if this be removed immediately after the animal is killed, the flesh will be untainted and highly toothsome. The general appearance of the pec-

cary is very similar to that of a small black pig, although their mane and hair are of much thicker growth.

H. B. Shinn.

THE CONY, OR HYRAX

The specimen of this animal presented here *(Hyrax abyssinicus)* is the best known of the species. It measures from ten to twelve inches in length; the fur consists of somewhat long, fine hairs, gray-brown at the base, lighter gray in the middle portions, merging into a dark-brown surmounted by a light-colored tip, the resulting general color of this combination being a mottled pale gray.

They are found in the wild, desolate mountain regions in Africa and western Asia. They inhabit all the mountains of Syria, Palestine, and Arabia, perhaps also of Persia, the Nile country, East, West, and South Africa. When startled by a canine foe, even after they have become hidden, safe from pursuit, in their rocky crevices, they continue to give utterance to their curious, tremulous yell, which resembles the cry of small monkeys.

In regard to their movements and mental characteristics, the conies have been placed between the unwieldy rhinoceros and the nimble rodent. They are excellent climbers. The soles of the feet are as elastic and springy as rubber, enabling the animal to contract and distend the middle cleft or fissure of its sole-pad at will, and thereby to secure a hold on a smooth surface by means of suction. In behavior the conies are gentle, simple, and timid.

C. C. Marble.

HYRAX.
$\frac{1}{4}$ Life-size.

CHAPTER VI

A GROUP OF RODENTS

THE group of Rodents as illustrated here is made up of a goodly number of mammals which, though they are as varied as the surroundings in which they live, yet exhibit certain fixed characteristics. In the first place, they are all mammals, having the body covered with fur or hair, nursing the young upon milk after birth, having a four-chambered heart, warm blood, and numerous other structural characteristics; most important of all is their well-developed brain and relatively high intelligence. As a group, the rodents are usually rather small, living in retirement in burrows, in hollow trees, or in some other well-protected nest; and their teeth are remarkable in that the incisors of the upper and lower jaws are especially strong and well developed, while the canines are absent; thus the rodents are not fitted for eating flesh, but are limited in their diet to vegetation.

H. B. SHINN.

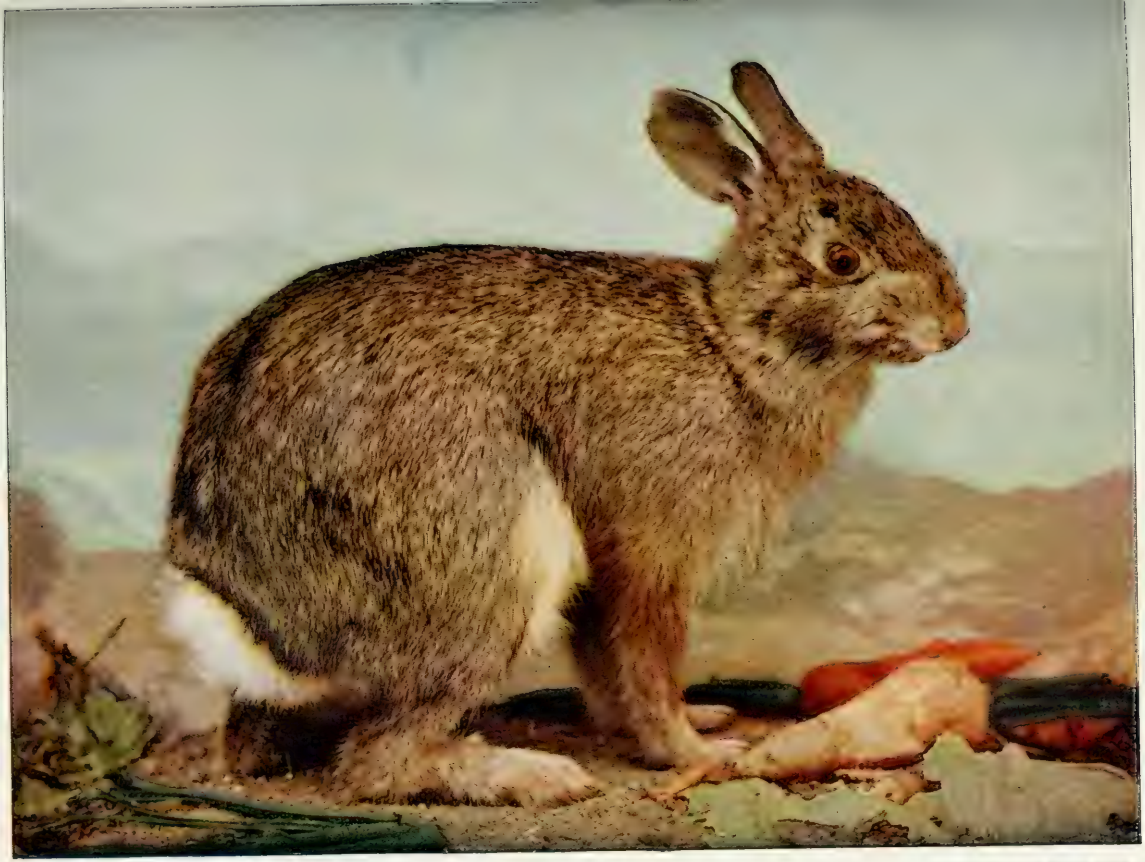
THE GRAY RABBIT

The Gray Rabbit, or Cotton-tail, one of the largest members of the rodent family, ranges from New England to Minnesota and southward to Central America, varying slightly from place to place. It is the common pet of children, as well as the source of winter income for many a boy

who possesses a gun. Like all other true rabbits, it is distinguished from the hares by its smaller size, relatively short ears, and short legs. It is not a good runner when caught in the open, but what it lacks in speed it makes up in cunning; when closely pursued it may double back upon its trail or dodge in and out of brush heaps and fences.

Its home is usually a burrow in the ground or a deep recess under the roots of an upturned tree. When the young are born they are naked and blind, but the mother plucks hair from her own breast to protect the little fellows and keep them warm. Upon leaving her nest she always covers them with this material, and instinct teaches them to lie still and make no noise which would betray their presence to any passing foe. As a call or warning, rabbits frequently beat a tattoo upon the ground with their hind feet; when running, the flashing of the white hair on the under side of the stubby tail wigwags a signal to playmates or companions.

Like other rodents, rabbits feed upon vegetation, in the summer eating carrots, parsnips, and other green material, while in winter, should a crust form upon the snow and prevent their reaching herbage underneath, they strip the green bark from trees and bushes, thus frequently doing great damage to fruit orchards. To prevent this, many orchardists use tree protectors of woven wire. The flesh of rabbits is highly esteemed and the pelt is treated in various ways to make it valuable in the manufacture of furs. The fur is so light in weight and the skin is so thin that the pelt is not valuable except for felt hats. H. B. Shinn.



GRAY RABBIT.
½ Life-size.

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NORTHERN HARE.
[illegible]

THE NORTHERN PRAIRIE HARE*

This is the most northern species of the group of Hares *(Lepus campestris)*, familiarly known in the United States as Jack Rabbits, because of their large size and enormous ears. They are lively animals of astounding jumping powers.

This Northern species is found on the Western prairies from British America to Colorado. It undergoes a winter change of coat, becoming nearly white, but the blanching is never complete, and russet streaks or patches remain through the winter.

Hares are a very important article of commerce and, during the winter season, tons of them are shipped daily to the principal markets, from all quarters. They are sold at cheap rates, and are frequently peddled about the streets by the cartload, at surprisingly low figures.

Hares do not live in burrows, as is the case with the rabbit, but lie in a form in bush or thicket, a slight depression in the ground serving for a nest, or sometimes a hollow stump, or the under side of a ledge of rock is selected. The young, when born, are covered with hair, their eyes are open, and they are able almost immediately to support themselves. The rabbit, on the other hand, is born with closed eyes, and requires the constant attention of the mother for some time. The hares are not so prolific as the rabbits, the female bringing forth but from three to five young at a litter, the rabbits bearing from five to eight.

Hares generally feed at night, lying in their forms in

some bush or copse during the greater part of the day. The food of the hare consists of all kinds of vegetables similar in nature to cabbage and turnips, which are favorite dainties with it; it is also especially fond of lettuce and parsley.

THE FLYING SQUIRREL

The Flying Squirrel is a creature of the night in the Northern woods; because of his disposition and his limitations in structure, he is not fitted to compete with other animals in civilization. He is seldom, if ever, seen, then, except in districts which are very close to the original wilderness. The skin along the sides of the body between the fore and hind legs is very full and loose; when the legs are outstretched this skin is drawn outward to form an expansion which enables the possessor to fall through the air more slowly than he otherwise would, very much after the manner of a parachute. It is the custom of the flying squirrel in leaping to sail outward and downward from some high point, arriving near the base of another tree, up which it will run until the act can be repeated. When running freely on the ground the creature is at a great disadvantage, and it rarely permits itself to be surprised in such a situation. These squirrels are small, gray above, and almost white below.

That the flying squirrel makes a very charming pet is shown by the following extract from "American Animals":

"Professor King, in describing some that he kept in his house, says: 'I have never known wild animals that became so perfectly familiar and confiding as these young squirrels

FLYING SQUIRREL.
Sciuropterus volans (Linnaeus).
½ Life-size

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did; and they seemed to get far more enjoyment from playing upon my person than in any other place, running in and out of pockets and between my coat and vest. After the frolic was over they always esteemed it a great favor if I would allow them to crawl into my vest in front and go to sleep there, where they felt the warmth of my body; and it was very rare indeed during the first six months that they failed to ask the privilege; indeed, they came to consider themselves abused if turned out. When forced to go to sleep by themselves, the attitude taken was amusing; the nose was placed upon the table or other object it happened to be upon, and then it would walk forward over it, rolling itself up until the nose almost protruded from between the hind legs; the tail was then wrapped in a horizontal coil about the feet, and the result was an exquisite little ball of life in soft fur which it seemed almost sacrilegious to touch.'"

H. B. Shinn.

THE CHIPMUNK

Naturalists, as well as many ordinary observers, it is said, recognize numerous varieties among the Chipmunks of the United States, founded principally on the markings of the fur; for in their habits they are all very similar. Elliott Coues describes four varieties found in this country.

The American Chipmunk, Hackee, or Chipping Squirrel is distributed all over the United States. The face is of a reddish-brown tint, with darker spots on the forehead and cheeks; the nape of the neck is ashen-gray, the hind quarters reddish-brown, the under surface whitish; there is a

dark brown stripe on the back, a black stripe over the eye, with white above and below it, and there is a wide white side streak edged with blackish-brown; the upper surface of the tail is dark brown, the base being grayish-yellow, the tip whitish, and the lower surface a ruddy hue.

The chipmunk is visible at all seasons of the year, but late in summer it may be seen running about, "its cheek pouches filled and its eyes beaming with the satisfaction which its riches afford it." According to the different months in which they mature, it gathers its varied stores, for the most part consisting of buckwheat, hazelnuts, maple seeds, and corn.

The young are born in May, and a second litter usually in August. It is said the males engage in fierce combats during the breeding season.

The beauty and gracefulness of the ground-squirrels render them interesting pets, but as they never become quite tame, are timid, and addicted to biting, and gnaw everything in the cage, they are not very desirable to keep. Their care presents no difficulties, and they thrive well on the simplest diet of grain and fruit. C. C. Marble.

THE GOPHER*

The Gopher may be found east of the Rocky Mountains and to the west of the Mississippi River, between the thirty-fourth and fifty-second parallel of north latitude. It leads an underground life, digging tunnels in various directions. Tunnels of old standing are packed hard and firm from constant use. Lateral passages branch off at inter-

CHIPMUNK
(Tamias [illegible])
Life-size

GOPHER

vals. The main chamber is situated under the roots of a tree at a depth of about four and one-half feet; the entrance tunnel is sunk down to it with a spiral direction. This chamber is large, is lined with soft grass, and serves for a nesting and sleeping place. The nest in which the young, numbering from five to seven, are born, about the beginning of April, is lined with the hair of the mother. It is surrounded with circular passages from which the tunnels radiate. Gesner found that a passage leads from the nest to a larger hole, the storeroom, which is usually filled with roots, potatoes, nuts, and seeds. When throwing up the earth the gopher exposes itself to view as little as possible, and immediately after accomplishing its purposes plunges back into its hole. According to Audubon, it appears above ground to bask in the sun. We have seen it sit at the entrance to its den with an air of bold indifference to the approach of danger and then suddenly vanish under ground. Its acute sense of hearing and great power of scent protect it from surprises.

Audubon kept several gophers in captivity for months, feeding them on potatoes. Their appetites were voracious, but they would drink neither water nor milk. They made incessant efforts to regain their liberty by gnawing through boxes and doors. They constantly dragged clothing and other similar objects together, utilizing them as bedding, first gnawing them to pieces. One of them, straying into a boot, instead of turning back, simply gnawed its way through the tip. The habit of gnawing was unendurable, and Audubon incontinently got rid of them.

The gopher is very destructive to valuable trees and

plants, for which reason man is its most dangerous enemy, the only other foes it has to fear being water and snakes. The name of gopher is applied in some American localities to various other rodents.

THE EUROPEAN SQUIRREL

This is regarded as the typical species among the tree squirrels, and its character and that of the common species of American squirrels are very similar. The attitudes of the animals are familiar to all who have watched the antics of squirrels in their arboreal homes. It is widely distributed throughout all of Europe and across the Caucasus and Ural through southern Siberia to the Altai and eastern Asia. Its favorite haunts are dry, shady forests with high trees, and it is as much averse to dampness as to sunshine. When fruit and nuts are ripe, it visits the gardens of villages, but only when they are connected with the forest by small tracts of trees or bushes. It will not attempt to forage far from the protection of the trees. Where there are many pine cones the squirrel makes its permanent home, and builds one or several habitations, usually in old crows' nests, which it improves very ingeniously. If it intends to make only a short stay, it uses the forsaken nests of magpies, crows, or birds of prey, just as it finds them.

The squirrel eats fruit or seeds, buds, twigs, shells, berries, grain, and mushrooms. The seeds, buds, and young shoots of fir and pine trees form its principal food. It bites pine cones off at the stem, comfortably sits down on its haunches, lifts the cone to its mouth with its fore paws,

EUROPEAN SQUIRREL
Latin name

GRAY SQUIRREL.
(Sciurus carolinensis)
⅝ Lifesize.

and, turning it constantly around, it bites off one little scale after another with its sharp teeth, until the kernel is reached, which it takes out with its tongue. Hazelnuts are a favorite dainty with it. Bitter kernels, like almonds, for instance, are poison to it; two bitter almonds are sufficient to kill it.

When food is abundant the squirrel lays by stores for less plenteous times. C. C. Marble.

THE GRAY OR BLACK SQUIRREL*

East of the Missouri River the Gray Squirrel is found almost everywhere, and is perhaps the most common variety. Wherever there is timber it is almost sure to be met with, and in many localities is very abundant, especially where it has had an opportunity to breed without unusual disturbance. Its usual color is pale gray above and white or yellowish-white beneath, but individuals of the species grade from this color through all the stages to jet black. Gray and Black Squirrels are often found associating together. They are said to be in every respect alike in the anatomy of their bodies, habits, and in every detail excepting the color, and by many sportsmen they are regarded as the same species, and that the black form is merely due to melanism, an anomaly not uncommon among animals. Whether this be the correct explanation may well be left to further scientific observation.

Like all the family the gray squirrels feed in the early morning, just after sunrise, and remain during the middle of the day in their hole or nest. It is in the early morning

or the late afternoon, when they again appear in search of the evening meal, that the wise hunter lies in wait for them. Then they may be heard and seen playing and chattering together till twilight. Sitting upright and motionless on a log, the intruder will rarely be discovered by them, but at the slightest movement they scamper away, hardly to return. This fact is taken advantage of by the sportsmen, and, says an observer, be he at all familiar with the runways of the squirrels at any particular locality, he may sit by the path and bag a goodly number. Gray and Black squirrels generally breed twice during the spring and summer, and have several young at a litter. The young mature in August and September.

We have been told that an incident of migration of squirrels of a very remarkable kind occurred a good many years ago, caused by lack of mast and other food, in New York State. When the creatures arrived at the Niagara River, their apparent destination being Canada, they seemed to hesitate before attempting to cross the swift-running stream. The current is very rapid, exceeding seven miles an hour. They finally ventured in the water, however, and with tails spread for sails, succeeded in making the opposite shore, but more than a mile below the point of entrance. They are better swimmers than one would fancy them to be, as they have much strength and endurance. We remember, when a boy, seeing some mischievous urchins repeatedly throw a tame squirrel into deep water for the cruel pleasure of watching it swim ashore. The "sport" was soon stopped, however, by a passer-by, who administered a rebuke that could hardly be forgotten.

BLACK SQUIRREL.
Linn.

ABERT'S SQUIRREL
Sciurus aberti
About ½ Life-size.

Squirrels are frequently domesticated and become as tame as any household tabby. Unfortunately, dogs and cats seem to show a relentless enmity toward them, as they do toward all rodents. The squirrel is willing to be friendly, and no doubt would gladly affiliate with them, but the instinct of the canine and the feline impels them to exterminate it.

THE ABERT'S SQUIRREL*

Abert's Squirrel is one of the handsomest as well as one of the largest of the American squirrels. Its range extends from central Colorado southward through Arizona and New Mexico into Mexico. It is abundant in nearly every part of this region, which is suited to its habits. The pine-covered sides of mountain ranges are its favorite feeding grounds, and it is rarely seen in other localities. Its food consists chiefly of pine seeds, but it also eats the acorns of the oaks which grow in the openings.

The beauty of Abert's squirrel is greatly enhanced by its long, full tail and the tuft of hairs which crowns its high and narrow ears. These hairs are directed upward and sometimes form a pencil fully as long as the height of the ear. The tufts, however, vary greatly in length, and may be entirely absent, for they are shed in the spring and new growths do not obtain their full development until early winter. The fur is long, full, and soft. The typical color on the upper half of the body is a bluish-gray; on the back there is a stripe of reddish or chestnut-brown fur extending from the shoulders to the base of the tail; on the under side

of the body the fur is pure white in color and is separated from the gray of the back by a more or less distinct black line. Individuals, however, vary greatly in color. They will vary from a reddish-brown to a uniform black throughout.

In spite of the fact that in its forest retreat it is well protected and is seldom molested by man, "it is often a shy and wary species, and, when it discovers an intruder, leaps with great celerity to the top of the pines, whose size and dense foliage screen and protect it." It is a hardy and muscular animal. When cornered, or if wounded, it shows great determination, fighting valiantly and biting viciously. Even when "mortally wounded it clings with surprising pertinacity, and for a long time, to its perch."

THE RED SQUIRREL*

Chickaree is the common name of the Red Squirrel, so called from the cry which it utters. It is one of the most interesting of the family, and a pleasing feature of rural life. During the last weeks of autumn the squirrel seems to be quite in its element, paying frequent visits to the nut trees and examining their fruit with a critical eye. In filling their little granaries, they detect every worm-eaten or defective nut, and select only the soundest fruit, conveying it, one by one, to its secret home. Feeding abundantly on the rich products of a fruitful season, the squirrel becomes very fat before the commencement of winter, and is then in its greatest beauty, the new fur having settled upon the body, and the new hair having covered the tail with its plumy fringe.

171

RED SQUIRREL.
⅔ Life size.

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FOX SQUIRREL.
Life-size.

Did you ever watch a squirrel open and eat the contents of a nut? It is very curious and interesting. The little fellow takes it daintily in his fore paws, seats himself deliberately, and then, carrying the nut to his mouth, clips off the tips with his sharp, chisel-edged incisor teeth. He then rapidly breaks away the shell, and, after peeling the husk from the kernel, eats it complacently, all the while furtively glancing about him, ever in readiness to vanish from his post at any suspicious disturbance. The food of the squirrel is not only vegetable substances. Young birds, eggs, and various insects constitute a part of his food.

The squirrel is a variable animal in point of color, the tint of its fur changing with the country it inhabits. It is easily tamed, and is a favorite domestic pet. It is said, however, that one should beware of purchasing so-called tame squirrels, as they are often drugged with strychnine, under whose influence they will permit themselves to be handled. In some cases the incisor teeth are drawn, to prevent them from biting.

THE FOX SQUIRREL*

Halleck states that the migrations of squirrels have never been satisfactorily explained. What instinct, he asks, brings together such immense droves of these animals from all parts of the country and causes them to move with solid phalanx to distant localities, overcoming all opposing obstacles? A few years since there was witnessed a wonderful sight by inhabitants of Pike County, Pennsylvania. An immense army of squirrels arrived at the banks of the Dela-

ware River late one night, and commenced its passage by swimming the next morning. The whole population turned out, and boys and men, equipped with large grain sacks and clubs, killed them by thousands. They kept coming in a continuous stream throughout the morning, and passed on to the woods beyond. Nothing could deflect them from their course, and they were evidently bound for a fixed point. A similar instance occurred some twenty-five years ago, where a vast assemblage crossed the Mississippi. While these migrations are obviously caused by a scarcity of food, it probably is not the only motive which induces them to undertake long journeys.

The Southern fox squirrel inhabits the Southern States from North Carolina to Texas. It is the largest and finest of our North American squirrels. Its color is oftenest gray above and white below, but it is also found of all shades of fulvous, and sometimes a deep, shining black; its ears and nose are always white. The Western fox squirrel occurs in the Mississippi Valley; its color is a rusty gray, and its ears and nose are never white.

Squirrels feed in the early morning, and disappear from eight to nine o'clock, remaining in their holes during the mid-day hours. They appear again in the late afternoon to feed.

THE POCKET OR KANGAROO RAT*

Rats and mice seem to enjoy living in localities that are frequented by but few other animals. They are also adepts at seeking food supplies, and travel long distances when

KANGAROO RAT AND CACTUS
(Dipodomys similis)
Life-size.

(Opp. 1488)

hunger demands and a sufficient supply of food is not at hand. The Pocket Rats are no exception to this rule, and some of the species live in those dry, arid regions where but little vegetation grows, aside from a few species of cactus.

The marked characteristic that gives these little animals their name is the pockets or cheek pouches. These are external openings outside of the mouth and are lined with a furry skin. They are ample in size and the two will hold, in some instances, a heaping tablespoonful of grain. The filling is done so rapidly that, where a hard grain like wheat is used, a continuous rattling sound is made. The ejecting of the grain from the pockets is aided by a forward, squeezing motion of the fore feet, each foot making two or three quick forward passes. When obtainable, their natural food consists of various plant seeds, but when in the neighborhood of cultivated fields and the vicinity of houses, they feed also upon grain and the vegetable waste from camps and houses.

The elongated hind legs, well pictured in our illustration, give these rats a wonderful power of locomotion. As they leap rather than run, they are often called Kangaroo Rats. They are nocturnal in their habits, seeking their food through the twilight and night hours, and resting during the day in their burrows or in shaded places near the openings to them.

When resting, the position of the feet and the arched back give them the appearance of a hairy ball. The tail is laid straight out from the body, if space will permit, or when the quarters are cramped it may be curled alongside

the body. The tail is quite useful, as it is used as a sort of brace when the animal raises itself on its hind feet to view its surroundings.

THE WOODCHUCK, OR GROUND-HOG

The Ground-hog or Woodchuck is one of the few animals which have thrived under the influence of civilization, though it would hardly be correct to say he has become civilized. By the elimination of the woodchuck's natural enemies, such as the fox and weasel, man has in a way granted him protection, and he is sufficiently prolific to bring about a rapid increase in numbers in any locality.

The ground-hog has a very coarse fur, which is seldom used, though the skin, when properly tanned, makes good shoe-strings, and may serve other purposes. As indicated by the shape of the body, the size and length of the legs, and the strong toe-nails, this fellow is essentially a digger. He can keep pace at this business with the ordinary farmer boy who tries to dig him out. The woodchuck frequently makes his home on a hillside, though he is not unwilling to live under a barn. His burrow usually has more than one entrance, seldom more than three. The burrow is so made that the living room is not far below the surface and not the lowest point of the tunnel, so that rain does not drain into it; it is well nigh impossible to drown out a woodchuck family. The male and female usually live in separate burrows, though at the time the litter is born they may be living together; the young leave the parent burrow in midsummer to make homes of their own.

COMMON GROUND HOG

CANADIAN PORCUPINE.
¼ Life size.

The woodchuck is strictly herbivorous and semi-nocturnal. It leaves the burrow in the late afternoon and returns to it not later than very early morning, though as fall approaches it spends more time foraging. It eats apples, sometimes climbing the tree to obtain them, and is very fond of melons and almost anything else which is succulent.

In feeding, the animal usually sits upright on its hind feet and holds the food to the mouth with the front feet. A full-grown animal is usually nearly two feet long, and ranges in color from brown to silver-gray. The ears are small and by muscles can be closed while the animal is digging. Woodchucks do some damage to farm crops, particularly garden stuff, and the burrows in the open field might mean the ruin of a horse through the breaking of its leg. The presence of a woodchuck on a farm adds considerable interest to a life which otherwise might be monotonous, and a quick interest in such relatively harmless animals is a thing to be stimulated. H. B. Shinn.

THE PORCUPINE

The Porcupine, though a member of the usually timid and defenseless rodent family, has developed an astonishing amount of what is usually called "cheek." It is a matter of speculation as to what would happen should a skunk and a porcupine meet on the same trail in the woods. The Canadian porcupine and its cousin, the yellow-haired porcupine of the far West, are quite similar to a European form called the hedgehog, though the habits of the American animals are so different from those of the other that the

two names should not be confused. Our forms feed upon the bark of trees and perhaps animal matter which they may discover still undecayed. The Canadian species is a good climber and frequently rests by day in the tops of trees, but the nest is made and the young are reared in some burrow or cavity in the ground.

The flesh is said to be too tough for eating and the skin is useless except as a curiosity. Along the back certain of the hairs have become very highly developed in size and stiffness, forming what are popularly called the "quills." The muscles of the skin cause these to be erected for defense or to lie flat when not needed. The development of this means of defense has rendered great intelligence unnecessary, and the animal has become slow of movement and dull of wit. As a last extremity in defense, the creature rolls itself into a ball, because the belly has upon it no quills and is defenseless; it is the weak spot in the armor.

A very good description of the habits of the porcupine is given in Burroughs' "Squirrels and Other Fur-Bearers." Portions of it are quoted here:

"When you come suddenly upon the porcupine in his native haunts, he draws his head back and down, puts up his shield, trails his broad tail, and waddles slowly away. His shield is the sheaf of larger quills upon his back, which he opens and spreads out in a circular form, so that the whole body is quite hidden beneath it. The porcupine's great chisel-like teeth, which are quite as formidable as those of the woodchuck, he does not appear to use at all in his defense, but relies entirely upon his quills, and when those fail him he is done for. The quill of a porcupine is

BEAVER.
(Castor fiber).
⅓ Life size.

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like a bad habit; if it once gets hold it constantly works deeper and deeper, though the quill has no power of motion in itself; it is the live, active flesh of its victim that draws it in by means of the barbed point." H. B. Shinn.

THE BEAVER

Very similar to the muskrat in habits is the Beaver, a real American and a member of one of our first families. Its weight may be as much as fifty pounds and its length between two and three feet. Owing to its habit of working by night it is rarely seen in the wilderness unless one should make it his business to watch a beaver pond at dusk. In order to make a pond in which to build homes similar to but more elaborate than those of the muskrat, beavers girdle trees, fell them by gnawing them off near the ground, cut the branches into suitable lengths, form of them the framework of a dam across some stream, and fill in the interstices with mud, which is carefully and solidly plastered into place with primitive trowels, it was formerly thought with the beavers' own tails. Not only does this pond serve as a moat outside the castle wall, but as a cool cellar wherein the food is stored. The food of the beaver is tender vegetation, particularly the growing bark of trees and the succulent twigs which are obtained in felling trees.

The beaver house is made of poles arranged in the form of a tent so that while its base rests upon the bottom of the pond the chamber within will be above the level of high water; many observers claim that the condition of a stream for the ensuing season is foretold by the beavers, for before

seasons of very high water the home is built unusually high. The instinct of home-building is so deep seated in the beaver's mind that in some cases young animals which have been reared in captivity have attempted to build a beaver house out of various articles at hand, such as umbrellas and canes. It is doubtless the case that the instinct, as such, exists in the beaver, but that many of the details of house-building are learned by observation during the first few seasons of a young beaver's life. H. B. Shinn.

THE MUSKRAT

The Muskrat, the largest and most valuable member of the great family of true rats, inhabits marshes, rivers, and lakes throughout the northern United States and Canada. Even has it come to dwell in isolated ponds in prairie country, doubtless migrating during the wet season. It is protected with a coat of fur which is valuable to the rat and at the same time valuable to man; especially is this true of those varieties living in the North. The pelt is sold under various names, perhaps the most pretentious one being Hudson seal. A good fresh pelt brings the boy who secures it anywhere from thirty cents to a dollar, varying upon the condition and color as well as upon the honesty of the furrier who fixes the price.

The length of a fair-sized animal is about two feet over all. The feet are comparatively small for so large a swimming creature, but the flattened tail, which is held in the same position as that of the fish and used in the same way, makes up whatever of motive power is lost through the

317

MUSKRAT.
Life-size.

smallness of the feet. It makes its home sometimes in burrows in the banks and sometimes far out in the pond or marsh, using for the purpose strong reeds or small sticks and mud. In every case the mouth of the burrow is below water and is entered by diving; thus it is protected very well from the weasel, ferret, and mink. The food material is sweet flag, lily bulbs, and roots, and fresh-water clams, and even fish.

H. B. SHINN.

CHAPTER VII

NOTED CARNIVOROUS ANIMALS

The carnivorous animals are so called because their diet consists almost exclusively of flesh. It is not often the case that the animal preyed upon stands quietly about awaiting capture; the captor is compelled to exercise every means at his disposal to get his dinner. The carnivora are, as a rule, then, of active, alert, and even ferocious disposition, endowed with great strength, of great craft, and fitted in various other ways to pursue the prey wherever it may go. Thus they are able to climb trees, to capture the tree-dwelling rodent, the squirrel; to enter burrows in pursuit of the rabbit or the chipmunk; to swim to the nest of a beaver; to catch fish, or to hunt across the open plain, running down the deer. As a group they are characterized by having the canine teeth especially well developed and the grinding teeth reduced from broad, heavy structures to more or less pointed and tearing ones. The mouth of a rodent is quite frequently under the face to a certain extent, while that of a carnivora is at the extremity. As a general thing, the flesh of carnivorous animals is not eaten by man; their fur frequently is very valuable.

H. B. Shinn.

THE AMERICAN OTTER*

In all parts of temperate North America, this, the most interesting of the otter family, makes its home on the banks of nearly all streams except those from which it has been driven by man. It has one peculiarity that is noticed by naturalists who have studied this animal, which is the habit of sliding or coasting down hill, in which it displays remarkable skill. In Canada and other sections where the snow is plentiful, otters indulge freely in this sport, and, says Godman, they select in winter the highest ridge of snow they can find, scramble to the top of it, "lie on their bellies with the forefeet bent backwards, and then, giving themselves an impulse with their hind legs, glide headforemost down the declivity, sometimes for the distance of twenty yards. This sport they continue, apparently with the keenest enjoyment, until fatigue or hunger induces them to desist."

The young are born in April in the northern and earlier in the southern part of the otter's range, and a litter is composed of from one to three young ones.

The skin of the American Otter is in high reputation and general use with furriers, but those from Canada are said to be more valuable than those from the more southern sections.

Rivers whose banks are thickly grown with forests are the favorite home of the otter. There, says Brehm, it lives in subterraneous burrows constructed in accordance with its tastes and mode of life. "The place of exit is always located below the surface of the water, usually at a depth of

AMERICAN OTTER

SKUNK
PLATE 50

about eighteen inches; a tunnel about two yards long leads thence, slanting upwards into a spacious chamber, which is lined with grass and always kept dry. Another narrow tunnel runs from the central chamber to the surface and aids in ventilation. Under all circumstances the otter has several retreats or homes." When the water rises it has recourse to trees or hollow trunks.

The otter is the fastest-swimming quadruped known. In the water it exhibits an astonishing agility, swimming in a nearly horizontal position with the greatest ease, diving and darting along beneath the surface with a speed equal if not superior to that of many fishes.

THE AMERICAN SKUNK*

This little animal is distinctively American, the one figured being found only in North America. It has a beautiful jet-black fur, varied with a larger or smaller amount of white forming a stripe on each side of its body and head and more or less of its tail. In some cases the white is reduced to a small "star" at the top of the head, and without doubt some specimens are entirely black, while occasionally a white specimen may be seen.

The fur of the black skunk is considered the best and brings the highest price, which decreases as the amount of white increases, the white ones being almost valueless. A slight unpleasant odor clings about the manufactured fur, which detracts much from its commercial value, although some dealers claim that this is never noticed when it is sold as "Alaska sable."

Another common name for the skunk is polecat. Though found in the woods, they prefer to inhabit grassy or bushy plains. During the day they lie sleeping in hollow trees or stumps, in clefts of rocks, or in caverns which they dig for themselves; at night they rouse themselves and eagerly seek for prey. Worms, insects, birds, and small animals, roots, and berries constitute their food.

The range of the skunk is quite extensive, the animal being most plentiful near Hudson Bay, whence it is distributed southward.

It is slow in its movements, can neither jump nor climb, but only walk or hop. Knowing how formidable is its weapon of protection, it is neither shy nor cowardly.

The skunk is a much-respected animal, both man and beast preferring to go around him rather than over him.

THE RACCOON

The Raccoon is one of the commonest carnivora in the United States, because of its docility proving a very satisfactory pet. The average size of the raccoon is slightly less than three feet. It feeds upon almost everything; while in summer it is particularly fond of green corn and garden crops, it does not disdain grubs, the eggs of birds, and even birds themselves if they can be caught napping. By day the raccoon usually sleeps high up in some hollow tree or in the crotch of a limb; by night it prowls about hunting for food or gamboling in some marshy place. The raccoon is too well known to need an extended description. The raccoon family usually consists of two parents with from

RACCOON.
½ Life-size.

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MINK.
In Life state.

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three to six babies, which are very carefully tended for a considerable time. The young are said to resemble kittens in their condition at birth. In the structure of the teeth and feet the raccoon is very similar to the bear, hence its diet and its methods of locomotion are similar. In disposition it is sly, cunning, and curious. It is said to go out of its way to run the length of a fallen tree and to spend hours playing with some shining object which may attract its attention.

Raccoon traps are often set having as a lure a piece of tin or a bright shell hung so that it will swing in the wind or placed on a trap-tongue in water near the shore.

H. B. Shinn.

THE MINK*

This soft fur-bearing animal has been described by Audubon and Prince Fe Wied. Its nearest relatives are very closely allied to the polecat and differ from it only by a flatter head, larger canine teeth, shorter legs, the presence of webs between the toes, a longer tail, and a lustrous fur, consisting of a close, smooth, short hair resembling otter fur. Its color is a uniform brown. The fur of the American Mink is much more esteemed than that of the European, as it is softer and of a more woolly character.

According to Audubon, the mink ranks next to the ermine in destructive capacity, prowling around the farmyard or duck-pond, and its presence is soon detected by the sudden disappearance of young chickens and ducklings. It will eat frogs or lizards, but when food is plentiful it is

very fastidious, preying upon rats, finches, and ducks, hares, oysters, and other shellfish; in short, it adapts itself to the locality and knows how to profit by whatever food supplies it may be able to find. When frightened it gives forth a very fetid odor like the polecat.

The female gives birth to five or six young at about the end of April. If taken young they get to be very tame and become real pets. Richardson saw one in the possession of a Canadian lady who used to carry it about with her in her pocket. It is easily caught in a trap of any kind, but its tenacity of life renders it difficult to shoot. The European mink much resembles the American, except that it is somewhat smaller and its fur is coarser.

THE FERRET*

It seems almost incredible that the ancestor of any animal which has been domesticated by man should be unknown, yet this is the case regarding the origin of the common Ferret. Nearly all of our modern scientists are agreed in believing the ferret to be a descendant of the polecat.

The ferret is not as active as the polecat, though in other respects it resembles that animal very closely. It has the same sanguinary instincts, and even when its appetite is fully satisfied it will continue to attack and kill other animals for the mere pleasure of satisfying an insatiable frenzy and an intense love of blood. It attacks reptiles and birds as well as mammals. It usually seizes the animal at the back of the neck, tearing the flesh and releasing its hold

FERRET.
Viverra furo.

WEASEL (Ermine)
⅔ Life-size.

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only when its prey is disabled. The ferret observes more caution in attacking reptiles, seeming to realize the dangerous character of venomous species.

The ferret is used to some extent in hunting rabbits, but more generally for the extermination of rats and other mammalian vermin. It must be especially trained for whichever purpose it is to be used. As a rule, a ferret that has only been used in hunting rabbits is afraid of the larger rats. Rats when cornered are courageous fighters and have been known to resist the attack of an untrained ferret and finally to have killed it. The courage and sanguinary nature of the ferret comes to it gradually, and the usual method of training a "ratter" is to begin with young rats or those that belong to the smaller species. Even before the first century of the Christian era the ferret was used in rabbit hunting. Pliny says, "The ferret is greatly esteemed for its skill in catching them. It is thrown into the burrows, with their numerous outlets, which the rabbits form, and from which circumstance they derive their name, and as it drives them out they are taken above."

THE WEASEL*

This is the smallest beast of prey, but so agile and courageous that it is regarded as a model of carnivorous animals. It dwells in fields, gardens, burrows, clefts of rock, under stones or wood piles, and roams around by day as well as by night. Its slender and attenuated shape enables it to enter and explore the habitations of the smallest animals, and, as it is a destroyer of rats, mice, and other

noxious animals, it is useful and deserves protection. It is, however, hunted by many who do not appreciate its value.

The Weasel attains a length of eight inches, including the tail. The body appears to be longer than it really is because the neck and head are of about the same circumference as the body. It is of the same thickness from head to tail.

This animal is found throughout Europe, Canada, and the northern portions of the United States. Plains, mountains, forests, populous districts, as well as the wilderness, are its home. It adapts itself to circumstances, and can find a suitable dwelling-place in any locality. It is found in barns, cellars, garrets, and similar retreats.

As soon as it catches sight of a human being it stands on its hind legs to obtain a better view. A naturalist once saw a large bird swoop down on a field, pick up a small animal, and fly upward with it. Suddenly the bird staggered in its flight and then dropped to the ground dead. A weasel tripped merrily away. It had severed its enemy's neck with its teeth and thus escaped.

The weasel preys upon mice, house rats, and water rats, moles, hares, rabbits, chickens, birds, lizards, snakes, frogs, fish, and crabs.

A litter of weasels numbers eight. The mother is very fond of the little blind creatures and nourishes them until long after they can see.

POLAR BEAR.
(Ursus maritimus).

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THE POLAR BEAR

The Polar Bear is the only aquatic member of the family, being often called Sea Bear, as the scientific name *(Ursus maritimus)* signifies. It is practically confined to the Arctic zone, although various unwilling visitants have come as far south as Iceland and Newfoundland on the floating cakes of ice. In size the polar bear ranks next to the grizzly, with a doubt, perhaps, in his favor. He has the strongest neck of any bear and finds it very useful in catching seals and fish under water. The coat is a silvery or creamy white, very long and thick, as might be expected in an animal which swims about in the Arctic Ocean and rests upon cakes of ice. The soles of the feet are very long and are covered with thick fur, which gives it a large unslippery surface and enables it to climb over ice with facility.

The food of the polar bear consists principally of fish and seals, but the walrus often falls a prey to his strength and cunning, and when starved this bear is known to eat marine grass in large quantities. Carcasses stranded on the beach, dead whales, and marine animals afford him an opportunity to gorge himself to the utmost and make enough fat to keep out the chill of Arctic waters. So fat do these great bears become that the female is able to bury herself in the snows of winter and hibernate, at the same time suckling her cubs until spring. The males do not hibernate, but may be seen all winter.

In Greenland the polar bear is known to swim from

island to island along the shores, eating the eggs and young of the innumerable birds which nest there.

Very few cows weigh fifteen hundred pounds, but this is the recorded weight of polar bears, "as great as any cow."

In hunting the polar bear the Eskimos usually pursue them with dogs, and, having surrounded them, kill them with spears and harpoons while they fight the dogs.

DANE COOLIDGE.

THE BLACK BEAR*

Bears may be classed under three groups: the Sea Bears, the Land Bears, and the Honey Bears.

The polar or white bear is the only representative of the first class. This species has been wonderfully provided for by Nature. Living, as it does, in the regions of perpetual ice and snow, the pure white color of its fur becomes a protection, as it is less easily observed. It also, unlike the other species, has the soles of its feet covered with hair, which enables it to move more freely and safely on the ice. They have been noted at a distance of fully fifty miles from the nearest shore, swimming without effort and showing no fatigue.

One of the best known of the land bears is the brown bear of northern Europe and Asia. It varies greatly and some authorities divide it into several distinct species. It is easily tamed, and because of the ease with which it supports itself on its hind feet it is often taught to step to the sound of music. Here. also, is classed the grizzly bear, which is nearly as large as the polar bear and much more

BLACK BEAR.
(Ursus americanus.)
Greatly reduced

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ferocious. It has been known to attack the bison and carry a body weighing one thousand pounds or more to its den, some distance away.

The Black Bear of our illustration is also a member of this class. It is a native of the wooded parts of North America. This species is timid though agile, strong, and is of great endurance. Its fur is soft and even and shining black in color. It can run more swiftly than can a man, and will escape in this manner if possible.

Though it principally feeds on herbs, fruits, and grains, it will also devour live stock of the smaller kinds, and may even attack cattle. In captivity they are much better natured than the other species. "They never make hostile use of their strength in their relations with their keepers, but completely acknowledge human supremacy and present no difficulties in their training. At any rate, they fear their keeper more than he does them."

The third class is illustrated by a single species, the sloth, or honey bear, also called the aswal. It is a native of India and frequents hilly localities. It feeds upon fruits, honey, and the lower animals, such as ants and the grubs of various insects. It also enjoys the comb and honey of bees. With its large and scythe-shaped claws it will destroy the strongly built homes of the white ants. In its native country the sloth is trained by jugglers to perform many tricks, and in captivity it is docile and comparatively good-natured.

THE WALRUS

The Walrus is a very fat, clumsy brute, much uglier than his picture, with a coarse, oily skin all wrinkled and scarred; long, protruding tusks; bristly whiskers, and scuffling flippers that barely serve to move his bulky body over the land. In the water he is more at home, and, though it does not require a high degree of strength and skill to dig clams, that being his daily occupation, yet he is able to keep very fat on the fruits of his industry and has much leisure to swim about or doze on ice floes and sea beaches.

It is only in the Arctic regions that walrus are found. Before the attacks of whalers and ivory hunters they were found as far south as Nova Scotia and the Gulf of St. Lawrence, but now they have retreated as far as possible into the frozen North, living in limited numbers about Hudson Bay, Davis Strait, and Greenland, and in Spitzbergen and northern Europe. In the northern Pacific before the slaughter began the walrus swarmed by thousands in the broad, shallow bays from the Alaskan Peninsula to Point Barrow, where ice never melts.

The food of the walrus consists of mollusks and crustaceans, which he digs from the muddy bottom with his long tusks, and the roots and stalks of sea-weed. He crushes the clams, shells and all, and swallows the mass, leaving digestion to proceed as it may. The stomach of a walrus killed in Bering Sea by Mr. Henry W. Elliott contained more than a bushel of crushed clams in their shells, with enough other food to make half a barrel.

STRIPED HYENA.
(Hyaena striata).

It is principally for its ivory tusks and the accumulated fat which comes from heavy eating that the walrus is now being exterminated by whalers and hunters. To the Eskimo the walrus means life itself. He eats the flesh, burns the fat for fuel and light, makes his boats, houses, harness, and harpoon lines from the hide, and trades what ivory he has not made into implements for the guns and whisky so acceptable to primitive man.

The young are born in the spring, and generally on the ice floes; but, being born fat, the ice floes are probably as warm to them as is a nest to a little mouse.

DANE COOLIDGE.

THE STRIPED HYENA

In spite of the large area in which the various members of the hyena family may be found, a traveler may be in the country some time without seeing one, for they are nocturnal in their habits, hiding by day in their haunts among the rock-cut tombs in Syria and Palestine or among holes and caves in the rocks in other countries, sometimes lurking among ruins, but more often inhabiting a den made by digging a hole in the side of a cliff or ravine.

But at night it is heard, if not seen, as it goes forth to seek its food. It prefers food already killed, and only attacks a living animal when driven to it by lack of carrion. Its powerful jaws enable it to crush the bones which other animals leave. As the cleaning up of the world must be done in some way for the good of all, can we not believe that the hyena has an important mission to fulfill in spite

of the strong feeling against it? It takes what other animals leave and is the vulture among beasts.

There seems to be little known about the brown hyena. It is found in a comparatively small region and is in some respects like the spotted hyena, though it is smaller, being about the size of the Striped Hyena.

The spotted hyena is the largest of the three, the most ferocious, stupid, and cruel. Owing to the legs being nearly of the same length, it is less awkward than the striped species.

The stories of the body-snatching propensities of the striped hyena are much exaggerated. If this occurs at all, it is when the body is very lightly covered with sand and when other food is lacking.

The dislike for the hyena seems to exist wherever the animal is found. In many parts of India, when killed, the body is treated with every mark of indignity and then burned.

And yet the striped species is capable of great attachment. Colonel Sykes states that "in certain districts in central India it is as susceptible of domestication as ordinary dogs." And Dr. Brehm, who found every created animal interesting, once had two young hyenas for pets.

JOHN AINSLIE.

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DOMESTIC CAT.
(Felis domestica).

CHAPTER VIII

THE CAT TRIBE

The members of the Cat tribe are characterized by the relatively short head, small ears, and retractile claws. The teeth of the cats are strictly carnivorous. Their disposition is ferocious, and they are not well adapted to domestication.

"All the members of the cat tribe are light, stealthy, and silent of foot, quick of ear and eye, and swift of attack. Most of them are possessed of the power of climbing trees and rocks, but some few species, such as the lion, are devoid of this capability."

THE DOMESTIC CAT

The Domestic Cat, while a comparatively popular animal at the present time, has enjoyed man's protection for relatively only a short time. It is definitely known that the Egyptians made a pet of this animal a long time ago, for it is pictured in ancient carvings, but it was only a few centuries ago that the cat was imported into northern and western Europe, where, for a long time, it was kept only by kings and princes. That it was not a common animal is indicated by the high esteem and reverence given to it in such stories as that of "Dick Whittington" and "Puss in Boots." As in the case of the dog, it is probably true that some of the breeds of domestic cats are developed from

unlike types of the many wild forms. Among the domestic forms may be mentioned the maltese, tiger, the angora, and the Manx cat.

The disposition of the cat, while such as easily to render it domestic, still keeps it without the pale of man's close friendship; it may submit to a certain amount of attention and care, and yet sooner or later it will revert to many of its wild ancestral traits. Thus, the hunting instinct will constantly assert itself, and, as well, many sneaking, thieving ways. In spite of all restraint the cat insists upon its nocturnal habits and a much greater amount of freedom to do as it pleases than does the dog. To be sure, there are many exceptions to these rules, but, on the whole, the statement will prove true. H. B. Shinn.

THE WILDCAT

The species of lynx found in forests in the United States is the red or bay lynx. Its popular name is Wildcat, but it is a true lynx, with the ear tufts characteristic of that group, and differs from the other members of it principally in the color of its fur. It is a resident of every part of the United States from ocean to ocean. The general color is usually red, but darker and sometimes nearly black along the backbone, while under the body it is whitish and on the breast pure white. The entire fur, except the breast, is covered with spots and streaks of darker fur. The length of the body and head is about fifty-three inches and the tail is six inches long. The color of the fur is of a brighter red in summer and a darker brownish-red in winter. Dif-

WILD CAT

BENGAL TIGER.
(Felis tigris).

ferent writers have classified several species of the American lynx, including the Texas lynx, which is found in Texas and southern California; the Oregon lynx, which inhabits northern Oregon and Washington. There is also a Florida lynx.

The natural home of the wildcat is a dense forest abounding in deep thickets and game. It rarely seeks sparsely wooded sections. Sometimes it will hunt the hare even on the plain, and a prairie fire will drive it to the neighborhood of settlements. It is capable of great endurance in walking, can leap an astonishing distance, climbs well, and is a good swimmer. Its sense of hearing is very acute and its sight keen. It is a night-prowler, hiding at the dawn of day and remaining still until evening. The wildcat selects for its lair a deep thicket, a cavern, or hole in a tree trunk.

Its fur is very valuable. The Scandinavian specimens are counted among the largest and finest. Siberia and Russia furnish many thousands of skins.

C. C. Marble.

THE BENGAL TIGER

The Bengal Tiger inhabits the hotter regions of southern Asia, but the species is found with certain color variations throughout the lower levels of all Asia from Siberia to the River Euphrates and as far south as Sumatra and Java. Next to the lion, it is the strongest and most ferocious of carnivorous animals, and, on account of the heavily wooded country in which it lives being densely populated, the tiger is even more destructive of human life.

In Bengal alone three hundred and forty-seven persons were reported killed by tigers in a single year, and this in spite of the best efforts of the government and people to mitigate the evil by poisoning, hunting, and trapping.

Among the English of India tiger hunting is a favorite sport. A most picturesque and safe way is to mount on an elephant and be driven about through the country, beating up the tigers from cover and shooting them with the huge four-bore rifles which the English sportsmen use. The principal danger lies in the stampeding of the elephant or the attack of a wounded tiger on the elephant himself.

An adult Bengal tiger measures ten feet from tip to tip, stands over three and a half feet in height, and weighs five hundred pounds.

In color the tiger matches the foliage of his native jungles. When lying in grass or even upon the ground the dark markings and rufous fawn colors of his body blend almost perfectly with his surroundings.

The tigress gives birth to from two to six cubs and is most affectionate toward them and aggressive toward intruders while she has them in charge. As soon as they can eat she begins to kill for them, and teaches them by a thousand cruel tricks to imitate her example. Not until they are nearly grown and able to kill for themselves does she separate herself and leave them to shift for themselves. Young tigers are far more destructive than old, killing three or four cattle and eating one, as if they wished to learn their duties in life well or were mad with the rage to kill.

DANE COOLIDGE.

AFRICAN LION.

THE AFRICAN LION*

The common opinion of the lion from the remotest times is that he is King of Beasts, and a single glance at his face of majesty is sufficient to make us accept it. His roar is terrific, and the fact is well known that all animals tremble at the mere sound of his voice. The effect of it on his subjects is said to be indescribable. "The howling hyena is stricken dumb, though not for long; the leopard ceases to grunt; the monkeys utter a loud gurgling sound and mount to the highest tree-tops; the antelopes rush through the bushes in a mad flight; a bleating flock becomes silent; the laden camel trembles and listens no longer to his driver's appeal, but throws load and rider off and seeks salvation in flight; the horse rears, snorts, and rushes back; the dog unused to the chase creeps up to his master with a wail." But it is said we must not think that the lion lets his roar reëcho through the wilderness at all times. His usual sounds are a deep growl and a long-drawn tone like the mewing of a giant cat. His real roar is uttered comparatively seldom, and many people who have visited countries inhabited by lions have never heard it. It is the only one of its kind and is surpassed in fullness of tone by the voice of no living creature except the male hippopotamus, according to Pechnel-Loesche. "The Arabs have a pertinent expression for it: 'raad,' meaning thunder. It seems to come from the very depth of the chest and to strain it to the utmost."

This lion is distributed all over central and southern

Africa. They are regularly met with on the banks of the Blue and White Nile, and in the deserts of central and southern Africa they are of common occurrence.

The lion leads a solitary life, living with his mate only during the breeding season. Selous says that in South Africa one more frequently meets four or five lions together than single specimens, and troops of ten or twelve are not extraordinary. His experience taught him that the South African Lion prefers feasting off the game some hunter has killed to exerting himself to capture his own prey. This is why he regularly follows nomadic tribes wherever they go; he regards them as his tributary subjects and the taxes he levies on them are indeed of the heaviest kind.

The cubs are usually two or three and the lioness treats them with great tenderness. They play together like kittens. In well-managed zoölogical gardens lions are now bred as carefully as dogs; and even in circuses, where the animals have but little room and often insufficient nourishment, they are born and sometimes grow up. The cubs are at first rather clumsy. They are born with their eyes open and are about half the size of a cat. Towards the close of the first year they are about the size of a strong dog. In the third year the mane begins to appear on the male, but full growth and distinction of sex, according to Brehm, are only completed in the sixth or seventh year. Lions in captivity have lived to be seventy years old.

Brehm, who loved the lion and was probably better acquainted with his habits than any other traveler, says: "The most prominent naturalists give the lion credit for qualities which, in my opinion, include nobility enough.

AFRICAN LION.
(Felis leo.)

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From col. Chi. Acad. Sciences.

AMERICAN OCELOT.
1/6 Life-size.

CHICAGO COLOTYPE CO., CHIC. & NEW YORK.

And whoever has become more closely acquainted with that animal; whoever has, like myself, intimately known a captive lion for years, must think as I do; he must love and esteem it as much as a human being can love and esteem any animal."

THE OCELOT*

The smaller spotted and striped species of the genus *Felis*, of both the Old and the New World, are commonly called tiger-cats. Of these, one of the best known and most beautifully marked, peculiar to the American continent, according to authority, has received the name of Ocelot *(Felis pardalis)*, though zoölogists are still undecided whether under this name several distinct species have not been included, or whether all the ocelots are to be referred to as a single species showing individual or racial variation. Their fur has always a tawny yellow or reddish-gray ground color, and is marked with black spots, aggregated in streaks and blotches, or in elongated rings inclosing an area which is rather darker than the general ground color. They range through the wooded parts of tropical America from Arkansas to Paraguay, and in their habits resemble the other smaller members of the cat tribe, being ready climbers and exceedingly bloodthirsty.

The fierceness of the disposition of this animal, usually called by the common name of wildcat, and its strength and agility are well known; for, although it is said that it does not seek to attack man, yet "when disturbed in its lair or hemmed in, it will spring with tiger-like ferocity on its

opponent, every hair on its body bristling with rage," and is altogether an ugly customer to meet with.

In length the ocelot rather exceeds four feet, of which the tail occupies a considerable portion. The height averages about eighteen inches. On account of the beauty of the fur the skin is valued for home use and exportation, and is extensively employed in the manufacture of various fancy articles of dress or luxury. It may be said to be a true leopard in miniature.

In its native wilds the ocelot seeks its food chiefly among the smaller mammalia and birds.

THE MOUNTAIN LION OR PUMA*

These are not the only names by which the Puma is known in the United States. He has different local names, such as tiger, cougar, catamount, and panther, or "painter," as the backwoodsmen entitle him, and silvery lion.

The puma ranges the whole of both the Americas from the Straits of Magellan to where the increasing cold in the north of Canada blocks his passage. Like many other large animals, however, the puma has retired before the advance of civilization, and in many of the more thickly populated portions of the United States a straggler, even, is rarely to be found.

All smaller, weak mammals are his prey—deer, sheep, colts, calves, and small quadrupeds generally. When, however, his prey is so large that it cannot all be devoured at one meal, the animal covers it with leaves or buries it in the earth, returning later to finish his repast.

PUMA.

The puma is a very bloodthirsty animal, and, whether hungry or not, usually attacks every animal, excepting dogs, that comes in his way. Ordinarily the puma will not attack man, fleeing, indeed, from him when surprised; but he has been known, when emboldened by hunger, to make such attacks.

It is the habit of the puma to spring upon its prey from an eminence, such as a ledge of rocks, a tree, or a slight rise of ground.

Very young cubs when captured soon become thoroughly tamed, enjoying the liberty of a house like a dog. When petted they purr like cats and manifest their affection in much the same manner. When displeased they growl, but a roar has never been heard from them.

Every movement of the puma is full of grace and vigor; he is said to make leaps of eighteen feet or more. His sight is keenest in the dusk and by night; his sense of smell is deficient, but his hearing is extremely acute.

The lair in which the female brings forth her young is usually in a shallow cavern on the face of some inaccessible cliff or ledge of rocks. The number of cubs is from two to five. In captivity two usually are born, but sometimes only one.

BLACK WOLF.
1/9 Life-size.

CHAPTER IX

THE DOG TRIBE

Dogs are a carnivorous tribe. They are characterized by their long pointed faces, prominent ears, bushy tails, and non-retractile claws. The teeth of dogs are not so strictly carnivorous as those of cats, hence their diet is not limited entirely to flesh, and their disposition is generally kindly. They are more adaptable to domestication than the cat tribe.

The dog tribe embraces not only all the wild and domesticated dogs, but also includes the wolves, foxes, and jackals. The origin of the dog is rather doubtful. Some eminent naturalists claim the dog is the offspring of the wolf and others claim the fox is the progenitor of the canine race.

All of our domestic dogs evidently came from a single species and are capable of breeding into almost unlimited variations.

THE BLACK WOLF

The Black Wolf here illustrated is a variety of the gray occurring in the Florida Everglades, a district which until recently has been so inaccessible that various animal forms have been able to persist there long after their extermination elsewhere; a description of the gray wolf will apply almost equally well to the black. These fellows usually

attain a height of nearly three feet. They formerly ranged throughout North America, but have been eliminated from all districts except those very remote or sparsely settled. They are always hungry, always restless, and always skulking, except where their numbers are such as to give them courage.

In hunting, particularly during the winter, they travel in packs of from five to twenty, or even more. Their custom is to run down their quarry in open chase, a fox, a deer, or even a buffalo or bear. They frequently attack herds of cattle on the plains. The cattle, for protection, gather into a compact mass, keeping the calves at the center and standing or moving with their heads outward. The wolves circle around the herd in a constantly narrowing line, drawing inward and attempting to entice a member of the herd to rush outward.

If such an attempt proves to be successful the pack immediately cuts off its retreat and its life is lost. Occasionally a wolf will succeed in leaping upon the back of some member of the herd, and, jumping from one to another, it will create confusion and the demoralization of the mass.

The gray, or timber, wolf, and its smaller cousin, the prairie wolf, or coyote, are similar in habit, though the latter is slighter and smaller. Of the coyotes, there are believed to be several distinct varieties. The skins of wolves are not particularly valuable as fur, though they are often used for cheaper grades of rugs, fur coats, lap-robes, and gloves; the hair is too coarse to afford warmth. The price of the wolf skin is usually considerably less than a dollar.

COYOTE

Wolves are very hard animals to trap, but they are frequently killed by means of poisoned meat.

H. B. Shinn.

THE PRAIRIE WOLF OR COYOTE*

This species is more commonly known in the Western States by the name Coyote, where it makes night so hideous that novices unused to the "unearthly serenade" feel a dismal longing for other latitudes. It is in size about half way between the red fox and gray wolf. Its color is similar to that of its larger relative of the plains, but is of a more yellowish cast.

The Prairie Wolf is an inhabitant of the plains and mountains west of the Missouri River, and is said to be found from the British possessions south into Mexico, whence it derived its common name, coyote. It was formerly very numerous, but the increase of population and the disposition to hunt and destroy it have greatly reduced its numbers. The bison, which was formerly its prey, having become almost extinct, its food supply has been largely cut off. These wolves subsist on any refuse they can pick up, and are always found on the outskirts of settlements or forts, slinking here and there, eking out what subsistence they may by snatching any stray morsels of food that come in their way. In the southern portion of its range the coyote is a miserable cur, scarcely larger than the common fox.

Although members of the dog tribe, wolves are held in utter abhorrence by domesticated dogs. The stronger

pursue to destroy them, the weaker fly from them in terror. In the earlier part of English history wolves are frequently mentioned as a common and dreaded pest. They are still found in parts of France, Russia, and the whole of western Asia. They are very wary and dislike approaching anything resembling a trap. While the coyotes possess almost identically the same characteristics as other wolves, man has no reason to dread them unless he meets them in hungry packs.

THE AMERICAN RED FOX*

Probably more has been written regarding the Red Fox of both Europe and America than about any other mammalian animal. Its habits, its intelligence, its beauty, and its graceful motions, all have appealed to the poet and the writer of prose. It is the hero of many stories and myths, and it is the symbol of slyness, cunning, mischief, and deceit.

The red foxes of both America and Europe are very closely related, and by many naturalists they are looked upon as belonging to the same species, *Vulpes vulgaris*. Their habits are similar and the American form is fully as daring and crafty as its relative in Europe. The slight differences between the two forms are quite possibly due to the character of their environments. The American form is said not to possess the wind of the European and becomes exhausted much earlier in the chase. If this is true, however, the American Red Fox is cunning enough to find plenty of time to rest and thus prolong the chase indefinitely. While the American form is usually classified as a

AMERICAN RED FOX.

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SWIFT FOX.
¼ Life-size.

distinct species, *Vulpes fulvus,* there is strong evidence which would indicate that the American red fox of today may have descended from individuals of the European form which were introduced, in some maner, into America long ago. "No remains of the red fox have been found in the cave deposit of America, while those of the gray fox are abundant." The European species was evidently an ancient inhabitant, for fossilized remains are quite frequently found in caverns, associated with those of other animals.

The fox is disliked by sportsmen because it destroys the partridges and other game of his hunting range, and by the farmer because it preys upon his poultry yard and his lambs. Yet the fox is of considerable service to mankind, for it destroys many woodchucks and innumerable field mice and other noxious rodents.

THE KIT OR SWIFT FOX*

One of the smallest of the foxes is the Kit Fox, sometimes called the Swift Fox and also the Burrowing Fox, getting the latter name for the ability and rapidity with which it digs the holes in the ground in which it lives. It is an inhabitant of the Northwestern States and of the western Canadian provinces, covering the region from southeastern Nebraska northwest to British Columbia. Its length is about twenty inches, exclusive of the tail, which is about twelve inches long. The overhair is fine, the back is a pure gray, the sides yellow, and the under parts white. The ears are small and covered with hair and the soles are also hairy. The kit fox is much smaller in size than either the

gray or red fox, but has proportionately longer limbs than either of them.

The coat of the fox corresponds closely to his surroundings. Those species living on plains and deserts show the similarity of their color with that of the ground; the southern fox differs considerably from the northern and the fox of the mountains from that of the plains.

The fox usually selects his home in deep hollows, between rocks covered with branches, or between roots of trees. Whenever he can avoid doing so he does not dig a burrow himself, but establishes himself in some old, deserted badger's hole, or shares it with the badger in spite of the latter's objections. If it is possible, the fox excavates his burrows in mountain walls, so that the conduits lead upwards, without running close to the surface. In his prowlings he regards his security as paramount to every other consideration, according to fox hunters. He is suspicious, and only the pangs of hunger can goad him into reckless actions. Then he becomes bold.

Litters of young foxes are born about the end of April or the beginning of May. Their number varies between three and twelve.

THE GRAY FOX*

The only foxes that are hunted (the others only being taken by means of traps or poison) are the red and gray species. The Gray Fox is a more southern species than the red and is rarely found north of the state of Maine. Indeed it is said to be not common anywhere in New

AMERICAN GRAY FOX

Edm. H. Osthaus

England. In the southern states, however, it wholly replaces the red fox, and, according to Hallock, one of the best authorities on game animals in this country, causes quite as much annoyance to the farmer as does that proverbial and predatory animal, the terror of the hen-roost and the smaller rodents. The gray fox is somewhat smaller than the red and differs from him in being wholly dark gray "mixed hoary and black." He also differs from his northern cousin in being able to climb trees. Although not much of a runner, when hard pressed by the dog he will often ascend the trunk of a leaning tree, or will even climb an erect one, grasping the trunk in his arms as would a bear.

Foxes live in holes of their own making, generally in the loamy soil of a side hill, says an old fox hunter, and the she-fox bears four or five cubs at a litter.

Hallock says that an old she-fox with young, to supply them with food, will soon deplete the hen-roost and destroy both old and great numbers of very young chickens. They generally travel by night, follow regular runs, and are exceedingly shy of any invention for their capture, and the use of traps is almost futile. If caught in a trap, they will gnaw off the captured foot and escape, in which respect they fully support their ancient reputation for cunning.

THE DOG

The Irish setter is truest to the dog type while the pointer illustrates what man has done by careful breeding, in this case, producing an animal with short, smooth

hair. There are recognized about one hundred and eighty distinct breeds of domesticated dogs which are scattered throughout the world among all people. Some seven distinct types of wild dogs occur, or have recently existed in almost as many different parts of the globe. The domestic forms have probably been developed from various original types, for it would hardly have been possible for man to secure the many widely different breeds now existing from any single one of the original types. That man has regarded the dog either as a friend or as a servant from the most remote times is proven by the remains of dogs found in ancient sites of primitive man in Denmark, Germany, England, the lake dwellings of Switzerland, and in the cave remains in the mountains of France and Belgium. In one case the skeleton of a dog was found buried with that of a woman.

Among the present forms may be mentioned a few of the extreme cases: the hairless dogs of Mexico and Cuba and the heavy-coated one of the far North; the tiny lap-dogs of Japan, whose weight often does not exceed one and one-half pounds, and the large forms which have been bred for special work, such as the Saint Bernard, the Newfoundland, and the mastiff. In Belgium dogs are harnessed to small carts by street peddlers and made to serve as beasts of burden. In far northern countries where reindeer are not used, dog teams furnish the only means of transportation over long distances. In Scotland the shepherd often prizes his faithful friend more highly than his own son. An instance of this is well told in the story, "Bob, Son of Battle." In Mexico

IRISH SETTER.

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the primitive Indians in certain districts regard as sacred a certain breed, the Chihuahua, which is a small form averaging in weight from one to three pounds, of reddish color, almost hairless, and which is characterized by great sensitiveness and high intelligence. The Bushman of Australia has partially tamed the wild dog of the region, the dingo, using it largely as a means of protection about his home.

The two dogs pictured here are quite similar in habit and size; both are used in hunting, but the setter is the more sensitive of the two, the more responsive to kindness and house treatment. The pointer and the setter are usually trained by hunters to assume a rigid position the moment game is sighted, often stopping in the very act of making a step; such a position is illustrated. The domestic dog is subject to many of the ailments of man but is immune to others, and is subject to diseases of his own. Because most of these diseases are contagious, a sick dog should be carefully tended and either nursed back to health or, as painlessly as possible, put out of his misery.

H. B. Shinn.

KANGAROO.
In Life-size.

CHAPTER X

SOME STRANGE MAMMALS

THE most primitive order of the mammal is that of the duckbill, *Monotremata.* The next order is that of the opossum and kangaroo, *Marsupialia.* The following order is that represented here by the armadillo, *Edentata.* Following this let us place the order of whales, *Cete;* then the hoofed animals, *Ungulata;* the rodents, *Glires;* the bats, *Chiroptera;* the seals and the walruses, *Pinnipedia;* the flesheaters, *Ferae* or *Carnivora;* and lastly, the monkeys, apes, and man, *Primates.* This classification is not complete; it deals simply with those forms which are herein illustrated. H. B. SHINN.

KANGAROO

The Kangaroo and the Opossum belong to a group of mammals called *Marsupialia* because they possess on the stomach a pouch within which the young are kept and nursed for a considerable time after their birth. The young of the opossum, the kangaroo, and the mouse are said to be at birth of almost the same length, about three-fourths of an inch.

The kangaroo is a native of Australia, the form here illustrated being the gray kangaroo, "Old Man" or "Boomer." It stands about four feet high and weighs

almost two hundred pounds. The peculiar development of the legs is probably due to the habits of the animal, for it lives in regions where the grass grows tall and where the animal can get along only by rising out of the grass and jumping. In this action the tail probably acts not only as a rudder and balancer but also as a spring at the beginning of the jump. It is said that the kangaroo can jump twenty feet at a single bound. The fore legs merely catch the animal upon alighting and hold the food while it is being eaten.

It is a comparatively timid and defenseless creature, relying upon its color to escape notice and upon its marvelous speed to get away from its pursuer. It delivers a powerful blow with the hind foot. The structure of this foot is peculiar inasmuch as the middle toe only is well developed, the side ones being aborted. The kangaroo has been almost exterminated in Australia because its hide is valuable for tanning. It feeds upon herbage, fruits and the young twigs of bushes and low trees. It is intelligent and capable of domestication; when trained it easily learns to box with or without padded gloves.

H. B. Shinn.

VIRGINIAN OPOSSUM

The Opossum is the only member of the *Marsupialia* which inhabits North America. It is confined to the southern portion, its range not reaching much north of the Ohio River. The best known of the opossums is the Virginian.

This animal is about twenty inches long to the root of its tail, which appendage is fifteen inches in length. The

OPOSSUM.
½ Life-size.

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...OL. ACAD. SCIENCES.

CRAB-EATING OPOSSUM.

♂ Life-size.

color is pale grayish, the hair being nearly white with brown tips. The tail is nearly naked, and is prehensile; and the general aspect of the creature is ratlike. It produces in the spring from six to sixteen young ones which are placed by the mother in her pouch immediately after birth, and remain there until able to take care of themselves.

In its range it is extremely common, being frequently found living in the towns, where it acts as a scavenger by night, retiring for shelter by day upon the roofs of the houses or into the sewers. While it shows a liking for the abode of man, its principal haunts are in the woods. Its food, upon which it becomes fat and toothsome to the dusky palate, is persimmons and wild grapes, together with various berries and fruits that abound in the Southern States.

The opossum can hardly be classed among the game animals of America, yet its pursuit in the South in old plantation days used to afford the staple amusement for the dusky toilers of the cotton states. The animal is rather dull of wit and sluggish in habit, its only means of protection being to escape into the tree-top or by lying quiet to simulate death.

THE CRAB-EATING OPOSSUM*

The Crab-eating Opossum *(Philander philander)* is one of the largest of the family. The body is nine and one-half inches long, and the tail nearly thirteen inches. It has a wide range, extending throughout all of tropical America.

It is numerous in the woods of Brazil, preferring the proximity of swamps, which furnish it with crabs. It lives almost exclusively in trees, and descends to the ground only when it wishes to forage.

This opossum readily entraps smaller mammals, reptiles, and insects, and especially crabs, which are its favorite food. It preys upon birds and their nests, but it also eats fruit, and is said to visit poultry yards and to cause great devastation among chickens and pigeons.

The young of the crab-eating opossum differ in color from the old animals. They are completely naked at birth, but when they are sufficiently developed to leave the pouch, they grow a short, silky fur of a shining nut-brown color, which gradually deepens into the dark brownish-black color of maturity.

The opossum is extensively hunted on account of the havoc it works among poultry.

The negroes are its enemies, and kill it whenever and wherever they can. The flesh is said to be unpalatable to most white persons, for two glands impart a very strong and repellent odor of garlic to it; but the negroes like it, and the flesh repays them for the trouble of the pursuit. The opossum, however, is not easily killed, and resorts to dissimulation when hard pressed, rolls up like a ball, and feigns to be dead. To any one not acquainted with its habits, the open jaws, the extended tongue, the dimmed eyes, would be ample confirmation of it, but the experienced observer knows that it is only "'possuming," and that as soon as the enemy withdraws it will gradually get on its legs and make for the woods.

ARMADILLO
(Dasypus sp.)

THE ARMADILLO*

All Armadillos bear the name Fatu in the South American Guarau Indian language. Although the name is of Spanish origin, the Indian term fatu has also been adopted in European languages, except in the single case of the six-banded species. They are all of more or less similar appearance and habits. They are natives of the southern American belt, extending as far north as Mexico, and the specimen presented here was taken in Texas, where it is occasionally found. The armadillos are at home in sparsely grown and sandy plains, and in fields on the edges of woods, which, however, they never enter. During the breeding season they consort together, but at all other times lead solitary lives and show no regard for any living thing except as it may serve for food.

Singular as it may appear, armadillos do not have a regular abiding place, and they frequently change their homes. They can dig a hole in the ground five or six feet deep with such expedition that they are able to have several places of retreat. The hole is circular, the entrance from eight to twenty-four inches wide, and at the bottom there is a snug chamber large enough for them to turn around in. They are great night rovers and seldom move about by daylight, the glaring sunlight dazing them. When seen during the day it is always in rainy weather, when the sky is overcast. It has been shown that armadillos excavate their burrows under the hills of ants or termites, where they are able to gather their principal food with the greatest

convenience by day as well as by night. Besides the foregoing, they eat caterpillars, lizards, and earth worms, and are thus advantageous to the husbandman. Plants also constitute a part of their diet.

THE HOARY BAT*

A very singular animal is the Bat, and it seems to belong to several classes and orders. The specimen we present here is very rare in this part of the country, and was taken in Lincoln Park, Chicago. It flies through the air like a bird, and, possessing mammæ, like the quadrupeds, suckles its young. The double jaw is provided with three kinds of teeth. With the canines and incisors it tears its prey like carnivorous animals, and with the molars or grinders it cracks nuts like rodents, which it resembles in the narrow, oval form of its head. An imperfect quadruped when on the ground, it drags itself along, embarrassed by the mantle of its wings, which fold up around its legs like an umbrella when closed. When it undertakes to fly it does so in an awkward manner. It first crawls painfully along, and with great difficulty extends its long fingers, spreading out the membrane which covers and binds them together. The ungainly creature then quickly flaps its broad wings, tough as leather, but thin and transparent; a bird without plumage, it now flies abroad in pursuit of insects nocturnal like itself, or in search of ripe fruit, to which some species are particularly destructive.

The more closely we approach the torrid zone, the greater is the number of bats and the richer their variety.

HOARY BAT.
½ Life-size.

BROWN AND RED BAT.
½ Life size.

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The South is the native country of the majority of wing-handed animals. Even in Italy, Greece, and Spain the number of bats is surprising. There, according to Brehm, who studied them industriously, as evening draws nigh, they come out of their nooks and corners, not by hundreds, but by thousands. Out of every house, every old stone wall, every rocky hollow, they flutter, as if a great army were preparing for a parade, and the entire horizon is literally filled with them.

THE BAT

The Red Bat is the commonest one in the United States. It is a little creature, hiding in the dense foliage of some large tree or under the eaves of a barn during the day and flitting erratically to and fro at night in search of the large night-flying moths and such other small game as may be on the wing. The brown bat is more southerly in its home than the red bat, seldom occurring north of the Ohio Valley. It is somewhat larger than the red bat, but its habits are the same. In the early evening it is a common trick for a boy to throw up his hat; into it the bat will dart, probably mistaking it for something to be attacked. As both come tumbling down the boy may seize the bat, only to get a sharp bite on the finger or to find that the vermin with which this hairy creature is infested has left the bat and is crawling on his person. Because the bat's hands have been changed into "wings," it is not able to keep itself clean, and it has become one of the dirtiest of creatures. These animals are active only during the early part of the night.

The young are nursed with the mother's milk, and at first are carried by her on her foraging expeditions.

The bat and the mole are so similar in internal structure that it would seem as though in some past time the ancestors of these animals had found that they could not successfully compete with birds in their search for insect food, and had decided to become nocturnal and aerial or to enter upon a burrowing life in the ground. To fit these creatures for such an existence the moles have become essentially diggers, while the bats have become fliers. The bat's thumb is still free, forming with its thumb-nail a tiny hook on the front edge of the wing, while the other four fingers have become elongated and connected with a delicate membrane of skin. This membrane is covered with fine down, though it is somewhat hairy near the body. The hind feet have not been greatly changed, and the five toes are of equal length and set close together. When at rest by day, the bat usually hangs head downward, though it can assume an erect position almost as conveniently.

H. B. Shinn.

DUCK-BILLED PLATIPUS*

We are indebted to Dr. George Bennett for the first good description of the Duck Mole, which was an object of wonder to naturalists long after its discovery.

The duck mole is about two feet in length, six inches of which are included in the tail. The males are larger than the females. The legs are very small, all four feet being five-toed and webbed. All the toes are very strong, blunt,

DUCK BILLED PLATIPUS
½ Life-size.

and excellently adapted for digging. The middle toes are the longest. The tail is flat and is broad at the end, the extremity being formed by long hairs. It is abruptly cut off, and in the old animals is either entirely naked beneath or covered with a few coarse hairs. In young animals it is quite hairy. The adult animal has only four horny teeth in its two jaws, of which the upper front tooth is broad and flat and resembles a grinder.

The fur of the duck mole consists of a coarse outer coat of a dark brown color with a silvery-white surface tinge, and a very soft, grayish inner fur, similar to that of the seal and the otter. It constructs more or less complicated burrows in the banks of rivers. A tunnel about eighteen feet long terminates in a large chamber, both the chamber and its approaches being strewn with dry aquatic plants. The chamber usually has two entrances, one below the surface of the water, and the other about twelve inches above. The duck mole likes to stay near the shore, amidst the mud, searching for its food between the roots of the plants, where insects abound. The mollusks which it captures in its forays it stores temporarily in its cheek pouches and then consumes them at greater leisure.

The duck mole lays several soft-shelled eggs. The eggs are hatched in the nest. The newly hatched young are small, naked, blind, and as helpless as those of the pouched animals. Their beaks are short.

THE COMMON AMERICAN MOLE*

This mole is the most common species in the eastern portion of the United States. Moles are considered as animals of a fairly high order, on account of their fore legs being developed into perfect scoops for digging. They live almost entirely in underground retreats, where they lead a very peculiar life. They are found over nearly all Europe, a greater part of Asia, southern Africa, and North America, and their habits are in almost every respect similar. Their varieties are not numerous, but it is possible that there are still a great many species as yet unknown to naturalists. They are all shaped and endowed, says Brehm, in so striking a manner as to be instantly recognizable. The body is stout and of cylindrical shape, and merges into a small head without the intervention of a distinct neck. The body is supported on short legs; the forward pair appear to be relatively gigantic digging tools, while the hind limbs are longer and resemble those of the rat. The teeth are from thirty-six to forty-four in number.

Moles all delight in fertile plains, though they are also found in mountains. As the effect of light is painful to them, they seldom come to the surface.

It was long thought that moles were blind, or had no eyes. The eyes, however, are about the size of a small seed, lie midway between the tip of the snout and the ears, and are completely covered with the hair of the head. They are protected by lids, and may be projected or retracted at will.

Once or twice a year the female mole gives birth to from

COMMON MOLE.
¾ Life-size.

HAIRY-TAILED MOLE

three to five young. They grow rapidly, and remain with the mother for one or two months. Then they begin digging on their own account and require no further attention. They have been found to be very difficult to keep in captivity by reason of their insatiable appetite.

THE HAIRY-TAILED MOLE*

The Hairy-tailed Mole is found principally in the western part of the United States.

This little animal has so many enemies besides man, as polecats, owls, ravens, storks, and the like, who watch it as it throws up its hillocks, that it is a wonder it has not been exterminated. It betrays its home by its own handiwork, as it is obliged constantly to construct new hillocks in order to earn its living. These hillocks always indicate the direction and extent of its hunting grounds. The little weasels pursue it in its conduits, where it also frequently falls a prey to the adder. Only foxes, weasels, hedgehogs, and the birds already mentioned eat it.

"Take the mole out of its proper sphere," says Wood, "and it is awkward and clumsy; but replace it in the familiar earth, and it becomes a different being — full of life and energy, and actuated by a fiery activity which seems quite inconsistent with its dull aspect and seemingly inert form. The absence of any external indication of eyes communicates a peculiar dullness to the creature's look, and the formation of the fore limbs gives an indescribable awkwardness to its gait. In the ground only is it happy, for there only can it develop its various capabilities. No one can witness the

eagerness with which it flings itself upon its prey, and the evident enjoyment with which it consumes its hapless victim, without perceiving that the creature is exultantly happy in its own peculiar way. His whole life is one of fury, and he eats like a starving tiger, tearing and rending his prey with claws and teeth. A mole has been seen to fling itself upon a small bird, tear its body open, and devour it while still palpitating with life."

The mole comes from the earth with unsoiled fur, which is due in part to the peculiar character of the hair, and partly to strong membraneous muscles beneath the skin, by means of which the animal gives itself a frequent and powerful shake.

THE WHALE

The Greenland, Polar, or Bowhead Whale is the most important member of the group *Cete,* not only because of size, for its average length is about fifty feet, but because of its commercial products. A single animal usually yields about twenty thousand quarts of oil and almost a ton of baleen, or whalebone; its total value sometimes amounts to ten thousand dollars. The flesh is seldom eaten except by the natives of the far North. This whale ranges throughout the Arctic Ocean and the higher latitudes of the Atlantic and Pacific oceans. It frequently gathers into schools, sometimes of large numbers.

The food of the whale consists of jellyfishes and other marine forms which exist in great quantities near the surface of the sea. These are taken into the mouth in one large gulp, the jaws shut, and the water is then forced out

GREENLAND WHALE

BOTTLE NOSE DOLPHIN

between plates of whalebone. The number of these plates varies from 300 to 360, and their length may be as much as sixteen feet; they hang like blades from the jaws and form a strainer. When breathing, the whale rises to the surface and from its nostrils and throat blows water and vapor in the form of a column, or "spout," to the height of fifteen or twenty feet. The mother usually gives birth to one offspring during March or April, and nurses it for several weeks. The baby grows very rapidly and the mother is extremely solicitous of its welfare, fighting to protect it even at the sacrifice of her own life.

The enemies of the whale are several species of the shark and a form of dolphin known as the killer whale, or orca. Perhaps the greatest enemy of the Greenland whale is man, who hunts it in a modern vessel with high-power engines and explosive bombs. Surrounding the body of the whale is a layer of fat, or blubber, often eight inches in thickness, which is cut from the body in chunks and fried out in caldrons on the deck of the vessel. The plates of baleen from the jaws are now used by being scraped very fine and mixed with the silk fiber of dress silks to make the cloth rustle when worn and to give it stiffness.

H. B. Shinn.

THE BOTTLE-NOSE DOLPHIN*

Dolphins, according to the best authorities, inhabit all oceans, and undertake great migrations, but are the only whales which frequent the rivers or even spend their whole lives in them, or in the lakes connected with them. They

are all gregarious, some of them collecting in very large shoals, and roaming about the sea together for weeks and weeks. Their liveliness, playfulness, and lack of shyness have earned them the friendship of sailors and poets from the remotest ages.

The Bottle-nose Dolphin is one of the best known members of the family. The snout is very long, like a beak, and protrudes from twelve to twenty-four inches. The range of this dolphin seems to be restricted to the Arctic Ocean and the north of the Atlantic, but it is known to make regular migrations a considerable distance south of it. Occasionally it appears on the coast of Great Britain. Cuttlefish, mollusks, and small fry compose its food.

Kuekenthal declares that its diving powers are remarkable; three hundred fathoms of line were taken off by a harpooned bottle-nose which remained forty-five minutes under water. They swim with such extraordinary speed that they not only follow the course of the swiftest steamer with ease, but gambol near it on their way, circling around it at will, and without being left behind. Occasionally one of them jerks himself up into the air, and, turning a somersault, falls noiselessly back into the water and hurriedly resumes his former position.

Several years ago we saw a school of dolphins swimming and frolicking in the East River on the way from New York Bay to Long Island Sound. They seemed to us like gigantic swine. They are very interesting to watch, and travelers find great pleasure in their company in crossing the ocean. Sometimes a small school of dolphins will play about the ship for days at a time.

RHESUS MONKEY.
(Macacus rhesus.)

CHAPTER XI

THE MONKEY TRIBE

THERE is a noticeable difference between the Baboon, the Rhesus Monkey, and the Chimpanzee, particularly in the presence or absence of the tail. An Ape is generally distinguished by the absence of the tail and the more or less man-like form of the body. The hands and feet are very similar to ours and the form of the skull, and resultant expression is more nearly human than that of the monkey. This does not mean in any sense that there is any direct relationship between man and a monkey or between man and an ape. Without going into too great detail as to the origin of things, one might say that much of the similarity between man and the ape is due to somewhat similar habits of life. An animal which walks upon only two feet must needs have a good foot; the body should be balanced almost directly over the supporting feet; the hands should be fitted for grasping objects, unless it be used for flight, and the head should be almost balanced—that is to say, the face should not project forward so much that it is not easily held up. The chin, then, would be shortened and the hinder portion of the skull more full and possibly the upper part of the skull more rounded than is the case with most other animals.

No scientist, even the most rabid evolutionist, claims that man is descended from the modern monkey; many evolu-

tionists, however, do believe that monkeys of to-day and man had a common ancestor in times long gone. Whether or not we all believe the same things, in the end it makes little difference; but most of us are curious to know what the rest of us think. Such eagerness to learn does not imply anxiety to believe; it is merely an outward sign of a hungry mind, which, if satisfied, will probably be a growing mind and not a dwarfed one. H. B. Shinn.

THE RHESUS MONKEY

It was in Simla that we first encountered the Rhesus Monkey.

Undoubtedly there is no more mischievous monkey than the rhesus, but, after all, he is not altogether to blame, for the blame may belong to the Hindoos. The Hindoos protect the monkeys in every possible way, willingly sharing their food with the bands which are found almost everywhere, and permitting no one to kill them.

This fosters every mischievous trait in these monkeys, and they fear nothing from man. They will devastate every plantation and garden near them. They belong to that genus of the ape family called Macaque, and as this variety, with their near relations, the other macaques, are found all over southeastern Asia, besides one branch in western Africa, one can readily see that their mischievousness becomes a serious drawback.

The natives of Baka are said to leave one-tenth of their harvest in heaps for the monkeys, which come down in great numbers and carry away all that is left for them. And this

MIRIKI SPIDER MONKEY
(Ateles hypoxanthus

they can readily do on account of their well-developed cheek pouches. These pockets in the cheeks are assuredly most convenient, but are never found on American monkeys. The Old World monkeys are the narrow-nosed variety, while the American monkeys have the broad nose bone.

Our rhesus monkeys had, of course, the narrow nose bone. In color the fur was grayish or greenish on the upper part, yellowish over the hips, and white below. The tail was greenish above and gray under. The face, ears, and hands were of a light copper color.

The mother monkeys were most assiduous in the care of their young, but in educating them one of the most important lessons was to teach them to steal successfully. This the pupils learned with ease, and to find a rhesus monkey which could not steal would be a curiosity indeed.

JOHN AINSLIE.

THE MIRIKI SPIDER MONKEY

With his native guides, a gentleman was traveling one day through one of the wonderfully luxuriant tropical forests of eastern Brazil. They had left the Amazon River and had come southeast to the Province of Maranhao, where the roots, grasses, and plants sometimes weave themselves into vegetable bridges so solid that a man may go some distance without discovering that he has left the firm earth.

They had just passed over one of these natural bridges and had evidently reached the edge of the hidden pool, as they came to a dense growth of rosewood trees, and there

they saw a most unique and peculiar sight. The gentleman, being a stranger in Brazil, exclaimed with astonishment, for, hanging from the branches by their tails only, were a whole troop of monkeys.

As soon as the gentleman recovered from his surprise, he fired upon the troop and succeeded in slightly wounding one, which so maimed it that, uttering a loud yell, it fell to the ground and he was able to secure it. The others, frightened, quickly vanished.

When the troop could no longer be seen, the gentleman examined his wounded captive, and from what he knew of the characteristics of the ape family, to which all monkeys belong, he decided that without question he had secured a specimen of the Spider Monkey.

It was a young mother, and the baby monkey was clinging to her with its little arms around her neck and legs around her hips in a way not to impede her motions.

She was carefully examined by her captor, and he soon decided that the wound was not dangerous, and that with care he might be able to take her with her baby back with him to the United States.

In examining the fore paw, in order to find a thumb, nothing was there except a short stub devoid of a nail; her nose was broad and flat, and she had thirty-six teeth.

Surely she was a Miriki spider monkey and a fine specimen at that, but as this variety is usually found only farther south in Brazil, her captor was especially pleased to secure her.

I must tell you what a devoted and lovely mother she was to her helpless little baby. She would continually pet

COMMON BABOON.
½ Life-size.

this little fellow, lick its body, hug it, and fondle it: she would hold it in both hands, as if admiring it, and then would rock it to sleep in her arms. JOHN AINSLIE.

THE BABOON*

Naturalists seem to be agreed that the Baboons, while one of the most remarkable groups of the monkey family, are the ugliest, rudest, coarsest, and most repulsive representatives of it. The animal stands in the lowest degree of development of the monkey tribe, and possesses none of the nobler shapes and qualities of mind of other species. Aristotle called the baboons dog-headed monkeys, on account of the shape of their heads, which have a resemblance to that of a rude, fierce dog.

The baboons are found throughout Africa, Arabia, and India. In the main they are mountain monkeys, but also live in forests and are excellent tree-climbers. In the mountains they go as high as nine thousand to thirteen thousand feet above the sea level, but give preference to countries having an elevation of three thousand or four thousand feet. Old travelers assert that mountainous regions are their true home.

The food of the baboons consists chiefly of onions, tubers, grass, fruit, eggs, and insects of all kinds, but, as they have also a greedy appetite for animal food, they steal chickens and kill small antelopes. In plantations, and especially vineyards, they cause the greatest damage, and are even said to make their raids in an orderly, deliberate, and nearly military manner.

The moral traits of the baboons are quite in accord with their external appearance. Scheitlin describes them as all more or less bad fellows, "always savage, fierce, impudent, and malicious. Cunning and malice are common traits of all baboons, and a blind rage is the chief characteristic. A single word, a mocking smile, even a cross look, will sometimes throw the baboon into a rage, in which he loses all self-control."

THE CHIMPANZEE*

The Chimpanzee is considerably smaller than the gorilla; old males reach a height of sixty-four inches; females, forty-eight inches. The arms are long, reaching a little below the knee, and possess great muscular power. In the feet the large toe is separated from the others by a deep incision; and the sole is flat. The hair of the chimpanzee is smooth, the color usually black, but in some specimens it is a dull reddish-brown. Chimpanzees walk on all fours, resting themselves on the calloused backs of their hands. The toes of the feet are sometimes drawn in when walking. Naturalists say there is a strong inclination in this species to show remarkably varying individual types, which has led to controversies as to whether there were not several different species.

It was formerly believed that the chimpanzee was a gregarious animal, but it is now known that there are seldom more than five, or, at the utmost, ten living together. Sometimes, however, they gather in greater numbers for play. One observer claims to have seen at one time about fifty of

CHIMPANZEE.
A Life-size.

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them which had assembled on trees and amused themselves with screaming and drumming on the tree trunks. They shun human habitation. Their nests are built in trees, not at a great height from the ground. They break and twist and cross larger and smaller branches and support the whole on a strong bough. A nest will sometimes be found at the end of a bough, twenty or thirty feet from the ground. They change abiding places often in looking for food or for other reasons. Two or more nests are rarely seen in the same tree. Nests, properly so called, consisting of interwoven branches, as Du Chaillu describes, have not been seen by any of the other narrators.

When in repose the chimpanzee in the wild state usually assumes a sitting posture. He is often seen sitting or standing, but it is said that the minute he is detected he drops on all fours and flees. He is adept at climbing. In his play he swings himself from tree to tree and jumps with amazing agility. His food consists of fruits, nuts, buds, etc.

INDEX VOLUME V

	PAGE
Animals, Carnivorous	135
Hoofed	91
Antelope, Pigmy	93
Prong-horned	95
Armadillo	173
Baboon	187
Bat	175
Hoary	174
Bear, Black	144
Polar	143
Beaver	131
Beetle, Caterpillar Hunter	5
Fiery Hunter	59
Goldsmith	59
Horned Passalus	59
Pinch Bug	59
Rhinoceros	59
Searcher	58
Beetles	58
Bugs, Tumble	58
Burying	58
Bighorn	104
Bison	102
Buffalo	102
Butterfly	4
Cabbage	36
Dog-face	49
Hunter's	51
Leaf	53
Milkweed	50, 49
Monarch	50, 49
Mourning Cloak	50
New Argynnis	52
Painted Beauty	51
Peacock	49
Pearly-eyed Nymph	51
Red-Spotted Purple	49
Ruddy Sulphur-Spot	50
Silverspot	52
Southern Dog-face	51
White-Cabbage	51
Butterflies	35, 48
Clouded Sulphur	49
of the Temperate Zone	50
Papilio	48
Sulphur	48
Swallow-tail	48
Terias	48
Camel, Asiatic	108
Carnivorous Animals	135
Cat, Domestic	149
Tribe	149
Caterpillar	37
Cephalopoda	32
Chimpanzee	188
Chipmunk	117
Coleoptera	35
Cony	112
Coral, Alcyonaria	12
Anemones, Sea	10
Anthozoa	11, 12
Coenenchyma	12
Coral, Collenterata	10
Comb-Bearers	12
Ctenophora	12
Eugorgia Aurentiaca	15
Gorgoniacea	14
Hydrozoa	11
Organ	13
Pennatulacea	13
Plexauridæ	15
Polyps	10
Porifera	10
Precious	15
Red	15
Sarcosome	12
Scyphozoa	11
Sea Anemones	10
Sea Fans	12
Sea-Feathers	13
Sea-Pens	13
Sea Plumes	12
Tubipora Musica	13
Zoöphytes	10
Corals	10
Cotton-Tail	113
Cow	110
Coyote	161
Dog	165
Irish Setter	165
Pointer	165
Tribe	159
Dollars, Sand	18
Dolphin, Bottlenose	131
Dragon-Flies	56
Elephant	106
Elk, American	93
Ferret	140
Fish, Black Bass	81
Brook Trout	79
Calico Bass	74
Garpike	73
Graylings	80
Montana Grayling	80
Muskellunge	73
Rainbow Trout	75
Sunfish	72
Tribe	63
Yellow Perch	76
Yellowstone Cut-Throat Trout	77
Fish's Place in Nature	63
Fox, American Red	162
Burrowing	163
Gray	164
Kit	163
Swift	163
Gila Monster	86
Giraffe	109
Gopher	118
Grasshoppers	54
Common	55
Groundhog	128
Hackee	117
Hare, Northern Prairie	115

	PAGE
Hares	115
Hemiptera	35
Horse, Domestic	97
Hyena, Striped	147
Hyrax	112
Insect, Seventeen-year Locust	60
Tribe	35
Insects	59
Assassin Bug	60
Giant Water Bug	60
Harvest Fly	61
Kissing Bug	60
Leaf-footed Plant Bugs	59
Milkweed Bug	59
Toad Bug	61
Tree Bug	59
Tree Hopper	61
Water Scorpion	60
Kangaroo	169
Lepidoptera	35
Lion, African	153
Mountain	156
Lizard, Collared	83
Locust, Cord-winged	55
Mammals, Strange	169
Mink	139
Mole, Common American	178
Hairy-tailed	179
Monkey, Miriki Spider	185
Rhesus	184
Tribe	183
Monster, Gila	86
Moose, Alaskan	92
Moth, Atlas	40
Cecropia	41
Cynthia	38
Goat	36
Honey-Comb	36
Luna	42
Polyphemus	42
Promethea	41
Tiger	36
Vaporer	35
Moths and Butterflies	35
Mountain Lion	156
Muskrat	132
Nautilus	32
Pearly	32
Noted Hoofed Group	91
Ocelot	155
Opossum, Crab-eating	171
Virginian	170
Orthoptera	35
Otter, American	136
Oyster and its Relatives	26
Oysters, Pearl	27
Pearl Oysters	27
Pearls	15
Peccary	111
Pinch Bugs	59
Platipus, Duck-billed	176
Porcupine	129
Puma	156
Rabbit, Gray	113
Jack	115
Raccoon	138
Rat, Kangaroo	126
Pocket	126
Reptile Tribe	83
River Snails	29
Rock Shells	24
Rodents	113

	PAGE
Sand Dollars	18
Sea Urchins	18
Sheep, Domestic	105
Mountain	104
Shell, Abalone	31
Achatina	30
Agate	30
Apple Murex	24
Bleeding Tooth	32
Branched Rock	24
Bubble	32
Bullmus	30
Bullmus Ovatus	30
Bulla	32
Burnt Murex	25
Cerithium	32
Cochlostylas	30
Cockles	27
Conidæ	23
Cowries	21
Crepidula	31
Cypræa	23
Ear	31
Fissuridea	31
Haliotis	31
Heart-Shells	27
Helix Fidelis	30
Helix Pomatia	30
Horn	32
Horned Murex	25
Keyhole Limpet	32
Liguus Fasciatus	30
Limpet	31
Littorina	32
Mitra Pontificales	32
Money	21
Mussel	27
Nautilus	32
Nerita	32
Oyster and Its Relatives	26
Pearly Nautilus	32
Periwinkle	32
Polygyra Alabolabris	30
Pond Snails	28
Psammobiidæ	27
Purple Murex	25
River Snails	29
Root Murex	25
Scallop	27
Slipper	31
Snail, Violet Sea	23
Snails, Marine	31
Snails of the Ocean	31
Snails of the Pond, River and Brook	28
Snails of the Forest and Field	29
Snails, Pond	28
Snails, River	29
Spiny Venus	26
Strombus	32
Tellinas	27
Tree Snails	30
Tribe	9
Tridaena Gigas	27
Turban	32
Turbo	32
Two-colored Murex	26
Veneridæ	26
Venus Comb	24
Whelk	32
Wing-Shells	27
Shells and Shell-Fish	19
Marine	22

	PAGE
Shells, Neptune	22
Rock	24
Venus	26
Silkworm	37
Skunk, American	137
Black	137
Snails, Marine	31
of Pond, River and Brook	28
of the Forest and Field	29
of the Ocean	31
Pond	28
River	29
Tree	30
Violet Sea	23
Snapping-Turtle	87
Sponges	10
Squirrel, Abert's	123
Black	121
Chipping	117
European	120
Flying	116
Squirrel, Fox	125
Gray	121
Red	124
Starfishes	17
Tiger, Bengal	151
Toads, Horned	85
Tumble Bugs	58
Turtle, Geographic	89
Snapping	87
Ungulata	91
Urchins, Sea	18
Walrus	146
Wapiti	93
Weasel	141
Whale	180
Wildcat	150
Wolf, Black	159
Prairie	161
Woodchuck	128
Zebra	98